Engineering News-Record

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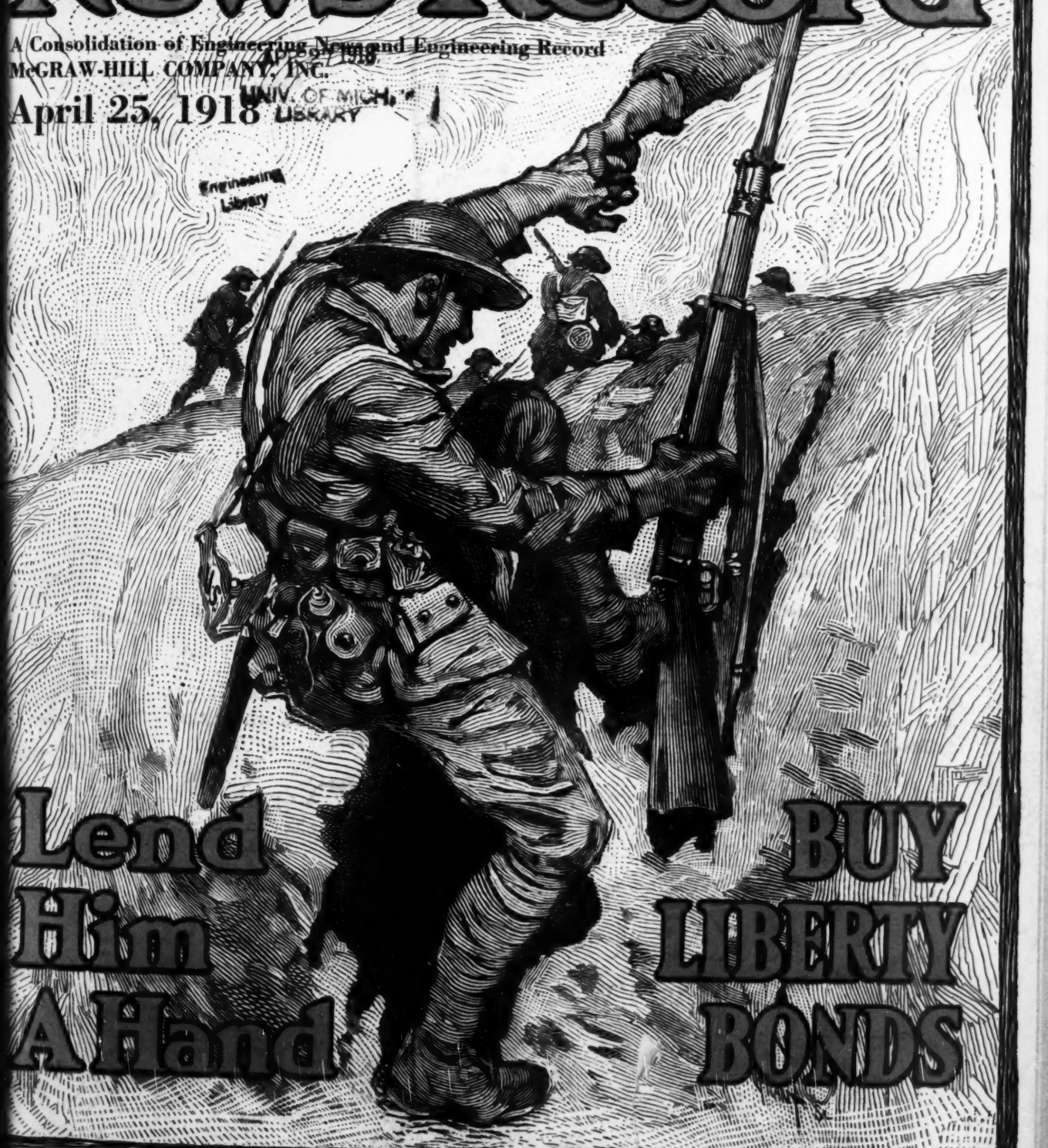

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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. Mehren, *Editor* — Charles Whiting Baker, *Consulting Editor*

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Delays in Delivery of News-Record

SUBSCRIBERS are fully justified in the complaints they are making regarding the delay in receiving copies of *Engineering News-Record*. Complaints have come to us from every part of the country and have been laid before the post-office officials in New York City and the Post-Office Department in Washington. This note is published so that all of our subscribers will realize that we are doing everything in our power to bring the Post-Office Department to a realization of the seriousness of the present situation. We shall continue to work with the department, in the hope that thereby deliveries may be restored to normal. In every case, the paper has come from the press at the proper time and been placed in the hands of the post-office authorities on schedule.

Has Control of Barge Canal Come Too Late?

IT WAS inevitable that the Government should take over the control of transportation of the New York State Barge Canal. Neither the State of New York through its legislative body nor the citizens of the state themselves could be aroused from their apathetic attitude toward this great water highway. A year ago there was some excuse for the lack of transportation facilities on the partly available canal. Today such an excuse does not exist. For twelve months the citizens of the state have been advised publicly and repeatedly of the early completion of the enlarged canal. Time and again they have been urged to take some action, either private or public, toward the construction of the barges, without which the canal is of no more value than the old Erie Canal which was merged into the new waterway. The appeals have fallen on deaf ears. Today there are at most half a dozen barges under way or completed to take advantage of the new depth of water and length of locks. Terminals are awaiting freight; locks are everywhere in a finished state; the entire line from the Great Lakes to the Hudson will soon be ready and waiting for traffic. There are lacking only the boats and the equally necessary organization for publicity and clerical control. These missing links must now be supplied from Washington. Unfortunately the present action comes too late for immediate value. Optimistic reports from Washington state that 700-ton steel barges (not yet even designed) will be ready in five to six weeks. Engineers familiar with ship and barge construction will believe this when it happens. The result of the whole program of procrastination is that the New York State Barge Canal, capable according to the estimate of the superintendent of public works of handling 10,000,000 tons per annum, will take care during the coming critical summer of but slightly more than the usual traffic of the primitive Erie Canal which it supersedes.

Director-General of the Fleet Corporation

CONFIDENCE that America will play its part in ship production has returned with the appointment of Charles M. Schwab as director-general of the Emergency Fleet Corporation. Not only engineers, but the general public, know that Mr. Schwab can and will secure the building of ships. By reason of his personality and great reputation, Mr. Schwab accomplished at a stroke the divorce of the construction organization from the Shipping Board proper and its removal to the center of ship construction at Philadelphia. It will be remembered that Admiral Harris resigned within a short time of his appointment as general manager of the Emergency Fleet Corporation after the immediate adoption of this same policy had been refused. The other difficulty with the building of ships which Admiral Harris foresaw, the housing of the workers, had to be met, more than a month before Mr. Schwab's appointment, by the appropriation of $50,000,000. But the chief ground for faith in the new head of ship construction is that, before the term "production engineer" was coined, he had become one of the greatest production engineers that the steel industry in this country has known. Neither is he new at the building of steel ships. The delays in the production and delivery of fabricated steel to the Government yards, which have become common knowledge of late, and which are traceable to fuel and railroad difficulties of the past winter, may be confidently expected to vanish before Mr. Schwab's genius.

J. Waldo Smith, Human Engineer

UNWITTINGLY, with utter modesty and self-effacement, the recipient of the John Fritz medal last week brought out, as the previous speakers had failed to do, the chief reason for rejoicing that he should have been chosen for the highest honor possible for an American engineer. It is found in the fact that J. Waldo Smith never misses an opportunity to share his laurels with his subordinates. He did not forget them on the occasion of his designation as the fourteenth to receive this emblem of high engineering achievement. He asserted that it would be presumptuous for him to as-

sume that the award was based on his individual work; and told of the ability and *esprit de corps* that had characterized his organization throughout. True enough, the spirit of the Catskill organization is far-famed; but J. Waldo Smith is responsible for that spirit, and without it the ability of his staff would have counted for far less. It is worthy of note that although there have been on this continent in the last generation other engineering achievements fairly comparable with the Catskill Aqueduct, only one other award has been made, since John Fritz himself in 1902 received the first medal bearing his name, for strictly civil engineering work. That was to the late Alfred Noble, who was also distinguished for his human qualities. There may be—let us hope there is—more than accident in the choosing for this high honor of an engineer who relies on developing a loyal staff rather than on exercising a domineering personality to accomplish big things, and who in his hour of triumph does not forget the men in the ranks who have worked with him.

American Engineers Again Prove Fighting Qualities

MANY have wondered how the American railroad regiments serving behind the Somme front acquitted themselves in the great German drive. It was known, of course, even before some of them proved it in the Cambrai action, that they would give a good account of themselves, whether they were obliged to work or had an opportunity to fight back; and it was most disquieting to their friends when the German general staff twice announced that their attack had routed American troops who could be none other than these engineers.

At last, however, the story has come out. After six weeks of the hardest kind of work building heavy bridges across the Somme, these engineers were caught by the great offensive and some of them almost cut off. In company with British engineers, however, these men destroyed an ammunition dump and escaped to their own lines. Heroic work by their regiment, which was in the light railroad service of the army that bore the brunt of the attack, resulted in saving much material that must otherwise have been abandoned, and called forth a letter from the corps commander which characterized their conduct as "beyond all praise."

But this was only the beginning. Fighting as infantry under their own commanding officer, this regiment constructed and held defensive works at Demuin, were withdrawn to another position which they fortified and held 8 days (during which time they were in "more or less continuous action"), and finally fell back under orders to Abbeville. Meanwhile a battalion of these engineers on Mar. 30 had assisted some British cavalry in a manner that called forth from the major general of the cavalry division a missive expressing his "thanks and congratulations to all ranks." Finally, the conduct of the engineers while they were holding a section of line in the height of the battle drew from General Rawlinson, commanding the British army in this region, a message in which he said, "I fully realize that it has been largely due to your assistance that the enemy has been checked, and I rely upon you to assist us still further during the few days which are still to come before I shall be able to relieve you in the line."

It is good to learn that, so far from having been wiped out, as the German reports of a month ago would indicate, this gallant regiment outwitted the enemy in destroying and withdrawing munitions, constructed and held against all assaults at least two important positions, rendered other assistance of value to our allies, and suffered in the entire period but 179 casualties.

This is the stuff of which Americans, and particularly American engineers, are made. Those of us who cannot get across to fight will spare nothing to send over all who can, and to keep them and our allies supplied with everything they can use to win complete victory.

Highway Transportation Problem Needs Study

MOTOR-TRUCK transportation has at last raised the highway problem to the same economic plane as railroad construction and operation. This was made plain by S. M. Williams when he told the New York Highway Traffic Association last week that a study of the present transportation situation would show the great ultimate, if not immediate, benefit of highway construction. At the same time, as Mr. Williams also brought out, the highways have never been investigated with the thoroughness that is necessary to prove their right to rank with the railroad or the waterway as a transportation agency.

The reason for this is not far to seek. Railways and waterways have always required more capital for their development than could be supplied at one time by the territory directly benefited. It was necessary for the promoters of such enterprises to prove their case to strangers who were careful to make sure that the investment would bring a return. Highways, until recently, have not been expensive, and even yet it is the universal custom to make the territory traversed pay for them in whole or in large part. It has simply been a question of whether the local population had use for a smoother road, and of how much it could be persuaded to pay for it.

Now, however, the highway has ceased to be merely the extension of our transportation system into regions where the railway cannot go, and therefore its cost of construction and operation can no longer be neglected. It cannot still be said that highway traffic must of course cost more than rail transportation, and that there is no use to attempt to compare the two, or to reduce the former to the same engineering basis on which the latter has been analyzed for decades. For the highway is actually competing, with the aid of the large, high-speed motor trucks, with the railway on something like even terms in carrying furniture, farm produce and perhaps some kinds of express matter. And this competition has at once forced on the attention of engineers the facts that the type and cost of road can no longer be neglected in reckoning the total transportation cost, nor can the selection of the kind of road needed be longer limited by what the local property holders are willing or able to pay. In many cases the territory traversed is no more concerned with a large proportion of the freight and passenger traffic over the highways than it is with through traffic carried by parallel railway lines; and it is only to be

expected that where local property holders are obliged by present laws to pay the greater proportion of the fixed charges on such traffic, they will attempt to limit it to kinds of travel on which the fixed charges are low.

The engineer must, of course, combat this tendency until the problem has been analyzed. We must know what the different cost factors are in motor-truck transportation, and how they combine in the handling of different classes of freight. The information now at hand is meager, and there is little chance that more complete data will be forthcoming unless some engineering body begins making studies of various conditions, and publishes the results.

What are the factors which should be reckoned with in attempting a solution of this problem, and what direction should an investigation of them take?

The labor cost of motor truck transportation as compared with the railway was stated to be 8 to 1 by A. C. Bedford in addressing the United States Chamber of Commerce on the subject. Whether or not this figure is strictly correct, it is accurate enough to show that increasing the size of the load hauled by one motor and one driver will reduce the total operating expenses. But the mechanical limit of weight to be borne on four or six wheels seems to have been reached with many present types of roads where solid tires are used.

We are faced at the outset, then, with the question whether it will pay to build better and costlier roads than any yet contemplated; whether it will pay to adopt the trailer idea with light units on present types of road; or whether the pneumatic tire, now being developed by at least one company for the heaviest loads, will not in the end prove the solution.

Again, the cost of the road itself not only is left out of most estimates of trucking costs, but is a factor which itself remains to be accurately determined. Before any progress can be made, it must be definitely known what present types of road cost for the entire period of their lives; and even this information is useless without knowledge of the kind and volume of traffic which used each road selected for a determination of cost.

Further, determination of the kind of road to be built, the weight of loads to be employed on it and the allocation of its first cost and maintenance, involve yet other factors. Not only must the present traffic be known, but the potential traffic must be accurately estimated and steps taken to develop it, just as must be done in opening a new railway. Also, it must be known that the traffic which the road is to carry can be taken care of more cheaply by highway than by other agencies.

With less than 400,000 motor trucks in the country out of a total of almost 5,000,000 motor vehicles, and with a monthly output of but 22,000 for all our truck factories; with a war of such seriousness in progress that it may limit the construction of roads, and possibly reduce roadwork to maintenance; and with a rapid growth of the use of highways for freight forced by rail congestion, conditions are ideal for a thorough study of the whole problem before the next great era of roadbuilding sets in. If the problem is attacked now, before large sums of money for highway construction on a country-wide scale are again available, engineers will know what types of roads to build, laws can be passed which will make their cost chargeable to the users who can afford to pay it, and it will be established what type of road and what kind of vehicle are most economical for a given locality and a given sort of traffic.

Buy All the Liberty Bonds You Can Carry

EVERY reader of this journal should buy bonds of the third Liberty Loan to the limit of his ability. The seriousness of this war has not been brought home to many of us. We hear it said that we are fighting for civilization against a ruthless enemy, and that failure will mean the extinction of democratic ideals; but do all of us realize that these statements are literally true, and that with the vanishing of democratic ideals, individual opportunity and all the possibilities which are contingent upon it would enter an eclipse which might last for decades? If we did, the Treasury Department would have been swamped with subscriptions in the first few days of the campaign.

We are fighting against a centralized government which has organized the population of Germany for selfish ends, with the ultimate object of reaching out to engulf the peoples of Europe and of the New World. Even over here we are feeling the effects of its offensive—not yet as the direct result of military conquest, but in the shape of insidious whisperings that we might be better governed under the German plan of centralized authority. Autocratic or socialistic, which does it matter? The Germans themselves have easily accepted the autocracy in lieu of the centralized paternalistic authority of the mass which socialism sets up, and can there be any doubt as to which, in the end, Germany would have triumph in Europe? Yes, and in America? To combat these treacherous undercurrents, the men in charge of affairs, among whom engineers are conspicuous, are organizing a democratic administration of industry and of production on a scale which has not been matched in history. We are going to prove to autocratic Germany that democratic America, a country in which every man has an opportunity and a voice in affairs, can get together with an efficiency which cannot be matched by any form of government imposed from above, because it draws energy from the limitless source of individual initiative.

But the immediate object of these men, and the most immediate object of all of us, is to train and equip overpowering armies, and build ships to transport them to the western battlefront before the Hun can win a success which might prolong the struggle for years.

To subscribe to Liberty Bonds is to make this national object your personal object—to give your means, as many engineers are today giving themselves.

If the readers of this journal will realize that we are banded together in a common enterprise of desperate import to each of us, that the last possession, if needed, must go to the common cause, that they are not investing for their pecuniary profit, but contributing that to which their country has the right, and which they might well be thankful to give outright, before May 4 it can be truly said that the entire engineering public has supported this loan to the limit of its ability.

Handling Machinery Feature of Erection of Ocean Pier

High Piledriver and Mobile Erecting Derrick Used on Heavy Timber Work on Canadian-Pacific Vancouver Freight and Passenger Terminal

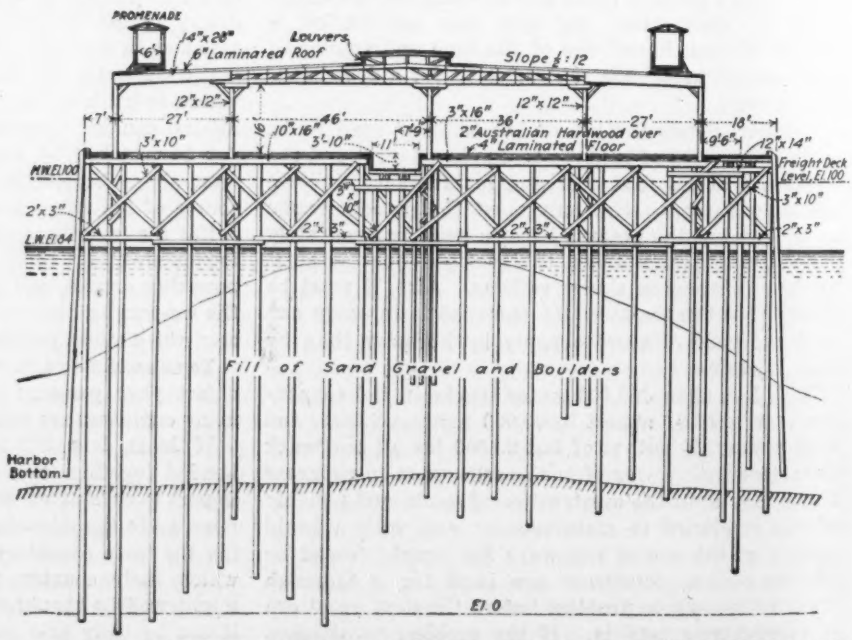
SOME of the longest timber piles ever used and exceptionally heavy timber framing went into the construction of the extension to the Canadian Pacific Railway's Pier D, recently completed at Vancouver, B. C. The work was much facilitated by the use of derricks and piledrivers which were readily movable across and along the pier structure and by an exceptionally high piledriver used in driving the longest of the foundation piles. In design and construction it is a remarkably good example of a heavy-timber ocean terminal.

Built in 1913, the older portion of the pier has been used mainly for coastwise passenger and freight traffic. It was 376 ft. long and 150 ft. wide, carrying a two-story structure, the lower deck being devoted to freight handling, the upper to passengers and office rooms. To this pier was added an extension 537 ft. long by 160 ft. wide, which runs to the pierhead line, making the total length of the pier 913 ft. The revised structure is to be used for two purposes. The west side and the outer end are to be used for coast boats and the east side for transpacific ships and miscellaneous freight traffic. Four coast boats and one long transpacific boat can be moored at a time. Along the ocean terminal side will extend a standard-gage track at the deck level and at that level on the other side and along the end is space for a motor truck. Passengers will be discharged on both sides and at the end to the roof of the new warehouse shed, which connects at the same level with the second story of the existing shed over the old portion.

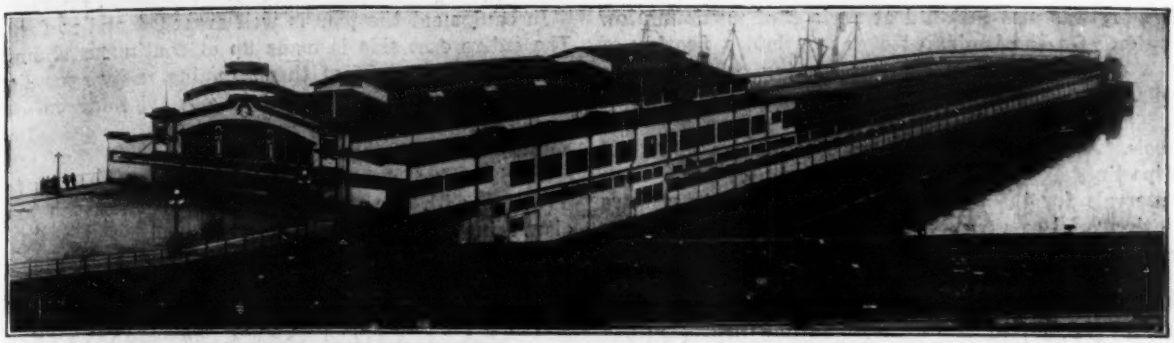
Creosoted piles and timber were used in the construction of the old pier, and investigation of the condition oceanward of that pier led to the use of a similar type of structure for the extension. Test holes in or near the area of the extension showed depths of water from 40 to 70 ft. at mean low tide with a tide range of approximately 16 ft. The harbor bottom was a mixture of mud, silt, sand and shell ranging from 10 to 30 ft. in depth, and below this were strata of clay and gravel. Hardpan lay from 70 to 140 ft. below low tide. With these conditions it was decided to cover the entire bottom where the extension was to go with a fill obtained from a dredging contractor making channel improvements about two miles from the pier site.

A fill about 250,000 cu. yd. in extent served to displace the soft harbor bottom and to provide end and lateral support to the piles. This also served to compress the lighter and softer material beneath until a point of equilibrium was reached where no further settlement of the fill would occur. Careful weekly soundings with a wash boring outfit were made over the entire area covered by the fill and along lines parallel to and outside of it. These soundings showed a slow but continuous settlement on the part of the fill and a slow corresponding rise at the bottom outside of it, until after a considerable period no further settlement could be observed. The piledriving began at that time. Afterward a dipper dredge removed enough of the outlying section of the fill to approximate roughly the weight of the structure later to be placed upon it, thereby maintaining the equilibrium reached by the filling process.

The type of substructure used is shown in the accompanying cross-section of the pier. On account of the extreme length of the piles required it was decided that concrete would not be used, but the presence of the teredo made some protection necessary. Therefore creosoted douglas fir piles with full 15-lb. treatment under the boiling process were determined upon. About 2550 piles, ranging in length from 85 to 125 ft., were used. It was also decided that all deck timber which was either in contact with the water or near enough to it to be continually damp should be treated. Bracing caps, stringers and laminated deck timbers were therefore specified for 12-lb. treatment under the boiling process. All this timber was of douglas fir of standard specifications.



ALL PILES DRIVEN INTO A FILL AND HEAVY TIMBER SUPERSTRUCTURE MARK NEW EXTENSION TO CANADIAN PACIFIC OCEAN PIER, VANCOUVER, B. C.



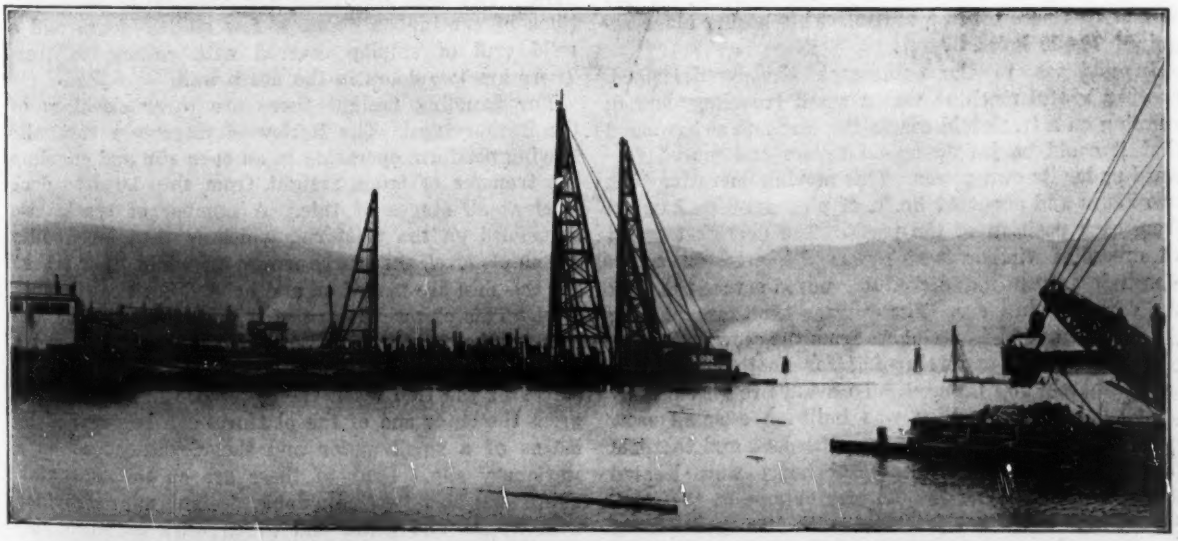
PASSENGERS USE SECOND FLOOR AND FREIGHT CARS RUN ON FIRST FLOOR OF CANADIAN PACIFIC PIER

Special attention was paid to the inspection of the creosoting of the piles. While they were being treated inspectors were kept at each plant and the quantity and quality of creosote used, temperatures, pressures and time of treatment carefully noted. Each pile was numbered and stamped after being passed and full data on its treatment recorded. When driving, a report was also made by an inspector on each driver as to the pile, number, location, penetration and length of cutoff, and it was thus possible readily to trace the history of any pile from time of treatment until driven.

The piledriving was started from floating drivers. On account of the extremely long piles a special driver had to be built. The one shown in several of the views, built by the pile contractor, S. Doe of Victoria, B. C., has leads measuring 130 ft. in height. This floating driver went ahead of the work and drove the longer of the foundation piles. It was assisted in the driving by the somewhat shorter floating machine shown in the general view. These two drivers worked in conjunction and roughly divided the piledriving, each driving from the center line of the pier out to the edges. In order to further increase the speed a skid driver was mounted on the pile structure and run down on the already driven piles to drive the special track piles supporting the railway tracks in the center and on the sides of the pier. It also put in a few column piles under the old deck which were omitted in building the original pier.

When piledriving was finished the skid driver was transformed into a skid derrick with an 80-ft. boom and used to erect the roof trusses. The roof framing as shown in the cross-section is of remarkably heavy construction, the beams over the outer 27-ft. bays being of 14 x 28-in. sticks. The center of the shed spanned by a low timber truss with rods vertical is divided into two unequal sections 46 ft. wide and 36 ft. wide in order to clear the central railway tracks. These trusses were framed and assembled on the deck and lifted complete onto the columns in one operation. They are carried on 12 x 12-in. sticks or columns with heavy brackets and corbels at the truss support.

Piles were capped by 10 x 16-in. and 12 x 14-in. creosoted timbers drift bolted into place. Capping was kept several bents behind the piledriving so that the jars from the driving would not change the elevation of the piles after they were cut off. Creosoted stringers were laid across the caps and drift bolted to them. Then a laminated creosoted 2 x 4-in. decking was laid diagonally on the stringers to give additional rigidity by tying several parallel pile bents together. Piles were also braced diagonally and additional longitudinal bracing was run down each side of the depressed track, the outside railroad track having its own special bracing.



STARTING THE EXTENSION TO THE CANADIAN PACIFIC, VANCOUVER, PIER D WITH THREE PILEDRIVERS. BORING MACHINE OUT BEYOND PIER. EXCAVATING FILLS TO PRESERVE EQUILIBRIUM AT RIGHT

Waling was also installed at periods of maximum low water. On the laminated deck was laid a flooring of 2 x 4-in. Australian hardwood running parallel to the pile bents.

The boring and drift bolting were done with air tools. A motor-driven air compressor was installed and pipe lines extended along the pier with connections at intervals for the tools. These comprised air riveters with special sets for drift-bolt driving and boring machines of various sizes. The bores were specially useful in laying the 2 x 4-in. hardwood floor, which had to be bored before being nailed. This boring alone required 70,000 holes.

VERY HEAVY TIMBERING WAS USED IN THE ONE-STORY SHED ON THE NEW PIER EXTENSION

In addition to the equipment already described, another useful machine was a small traveling derrick running on a track laid across the pier and so arranged that it could be jacked up on rollers and moved forward under its own power. This moving operation took two hours and about 40 lin.ft. of pier could be handled from each position of the track. The derrick handled all creosoted timber, which was delivered on scows alongside as required, picked up, moved across the dock and deposited in place. The average time for handling the 7 x 12-in. x 40-ft. stringers from the scow to the far side of the dock and returning for another load was approximately two minutes. To avoid fire risk a fully equipped blacksmith shop was built on a small scow and moored alongside at or near the dock and the field office; storehouse and compressor house were located at the extreme end of the old pier outside of the shed, where they would not interfere with the operation of the pier and yet where they would be easily accessible in case of need.

In equipment the pier is well arranged and modern. The entire east side is made up of continuous sliding doors. There are 95 of them running on two parallel tracks and overlapping. These doors are hung on adjustable rollers which will take up settlement. The bottom track is made up of T- and angle-irons left open through the deck so that nothing can collect to interfere with the working of the doors, which are glazed in the upper half and screened, with a 3-ft. section of window above them to provide additional light. The west side walls are made up of short sections of continuous doors, a few sliding doors and a solid wall of shiplap covered with corrugated iron. There are two doors in the north wall.

For handling freight there are three elevators of the Barlow type. The Barlow elevator is a vertically moving platform operating in an open slip and enabling the transfer of truck freight from ship level to dock level at all stages of tide. A number of trucks are assembled on the platform, which is then lowered to the ship's level, the trucks moved off while other trucks for the ship are moved on and hoisted back to the dock level. This elevator is operated by a 40-hp. motor, the operator being situated at one side where he can get a clear view of the dock and into the ship's side hatch. At stages of the tide when the difference in levels is not great the outer end of the platform can be dropped by means of a small motor and the elevator used as a stationary slip. Four of these are on the new pier. There are also two adjustable freight slips provided with worms and gears and which work as adjustable ramps. The center depressed track is fitted with an electrically driven car-haul with a capacity of ten

HIGH PILEDRIVER AT RIGHT, TRAVERSING DERRICK AND HIGHSKID DERRICK IN CENTER BEING USED TO BUILD NEW TIMBER PIER

loaded cars, so that no steam locomotives need be run onto the pier.

Motors with a total capacity of about 200 hp. are installed. The current is brought to a concrete transformer station at the south end of the pier and distributed in ducts. No transformers are allowed on the pier. Lighting current is also transformed at the pier and distributed by conduits, circuits being arranged so that practically any combination of light can be obtained. Lighting plugs are installed along the side of the depressed track to provide for portable lights for loading and unloading freight cars. Screened bracket lights are placed at 40-ft. intervals along the outside of the shed and red and green beacon lights at the outer ends.

Fuel oil lines are carried down each side of the pier with valves at the various boat landings. A covered water line is laid along the bottom of the roof trusses and branch lines are taken off at intervals for supplying boats and for fire protection. Hose valves and lines of hose laid on tilting hose racks are arranged to cover the entire pier area.

The entire construction of this extension was done by Sydney E. Junkins Co., Ltd., Vancouver, B. C., under the direction of J. G. Sullivan, chief engineer of the Canadian Pacific Ry., western lines, Winnipeg, and H. Rindal, engineer, Canadian Pacific Ry., Vancouver, B. C.

Provide Painters' Scaffolds on Bridges

Bridge engineers should provide in their structures eyebolts and other fastenings for hanging painters' scaffolds, says a paint expert of many years' experience. If the designer gives attention to this, little extra cost is involved in furnishing the bolts or hooks and that repainting can be managed safely and efficiently is assured. Paint applied with a swab on the end of a long pole is almost worthless, and yet this tool is used on much of the remote steelwork of a bridge, especially under the floor. Many highway bridges are never painted below the roadway level, which is perhaps one reason why serious corrosion is often found there. It is therefore worth while to provide special facilities for inspection and painting under the floor.

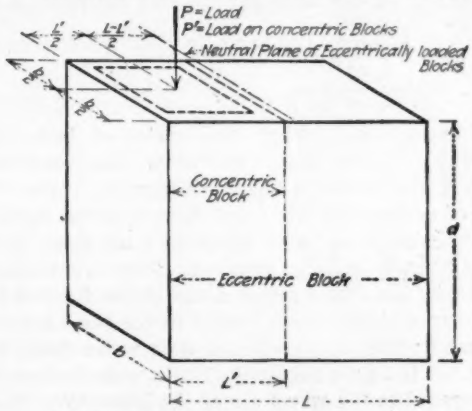
Eccentric Loading Tests Result Contrary to Theory

With Concrete Blocks Under Compression Adding Material Off Center of Load Does Not Decrease Strength

By John C. Prior
Associate Engineer, Braun, Fleming & Knollman, Consulting Engineers, Columbus, Ohio.

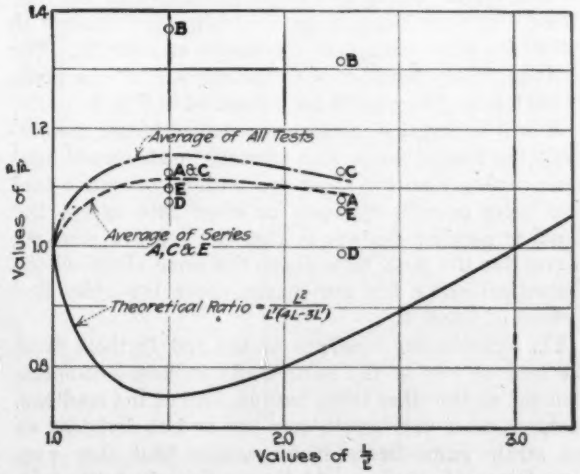
In an effort to discover the actual effect of eccentric loading on a short concrete block and to check up the theoretical reduction in strength due to certain kinds of material addition, the writer has had some tests made at Ohio State University. The results, on a limited number of specimens, do not seem to accord with the accepted theory of homogeneous and elastic bodies.

Occasionally the paradox of adding material and weakening the structure is encountered in engineering design



BLOCK ON WHICH TESTS WERE MADE

due to the load being placed in an eccentric position by the added material. One instance is recalled where the stresses in a concentrically loaded concrete column footing, founded on solid rock and 4 x 4 ft. in plan, were considered safe until for better working conditions it was deemed desirable to enlarge the footing to 4 x 6 ft., leaving the load in the same position with respect to three sides of the pier. After the change the stresses no longer fell within the safe limits and an expensive



TESTS SHOW RATIO OF LOADS GREATER THAN THEORY

cantilever beam was resorted to in order to eliminate the eccentricity.

Reported results of eccentric loading experiments on structural steel, which is one of the most perfectly elastic structural materials obtainable, check fairly closely with theory. The tests here described give some information concerning the accuracy of results obtained when the familiar formulæ for flexure and direct stress $f_c = \frac{P}{A} \pm \frac{Mv}{I}$ is applied to blocks composed of a material as imperfectly elastic and heterogeneous as plain concrete.

Referring to Fig. 1 it is evident that when the block is is L′ long, the maximum unit compression in the concrete $= f_c = \frac{P}{bL}$ and when it is L long, from the formula referred to in the preceding paragraph, $f_c = \frac{P}{bL} + \frac{3P(L - L')}{bL^2}$. If the unit compressive strength of the concrete is assumed the same in each block then the ratio $\frac{P}{P'} = \frac{L^2}{L'(4L - 3L')}$.

The experiments include five series of tests, each consisting of three blocks the sizes and composition of which are given in the accompanying table. The blocks of each series were cast from a single batch of concrete, great care being taken to tamp them in the molds as nearly alike as possible. They were allowed to stand in the forms under damp cloths for the first day or two and then were buried to the same depth in damp sand which was sprinkled with water from time to time. A few days before the blocks were broken they were exposed to the warm air of the laboratory. Every precaution was taken to treat each piece of any series exactly alike in order that the unit strength of the three blocks might be assumed equal. Well oiled wood forms were used and the finished block varied from the given dimensions less than one-sixteenth inch.

The specimens were crushed in a testing machine using 3 x 3-in. universal loading plate, the center of which was placed 2 in. from three sides of the test piece, making the load concentric for the 4-in. blocks. They were bedded in plaster of paris, as was also the loading plate. Deformations were recorded at the four corners of each block, using a strain gage reading to 0.0002-in. after each load increment of 5000 lb. The loads at failure together with the ratios P/P' are given in the table. The results are visualized in Fig. 2.

It will be noted in each series that although theoretically the longer blocks with eccentric loads should have been weaker than the short one with a concentric load they were actually stronger in every case except D9. Another peculiar feature is that the relative strength curves for the tests have about the same shape as the theoretical curve, but are convex above the unity line instead of below it.

The deformation readings at the end farthest from the load on two of the 9-in. blocks indicated compression and on the other three tension. All of the readings, however, were very small, only one or two divisions on the strain gage, hence it is possible that they may have been only errors. At the same end of the 6-in. blocks also both tension and compression were noted but the compression was much more marked. Theoretically the stress in the 6-in. pieces at the end away from the load should have been zero and in the 9-in. pieces the maximum tensile stress should have been 25% of the maximum compressive stress developed at the loaded end.

It is believed that the tests warrant the conclusion that in designing eccentrically loaded concrete piers or footings, resting on rock or such material that the foundation itself cannot be questioned, and of such a ratio of height to width that they need not be classed as long columns, only as much of the pier need be considered as will render the load concentric, that is to say all except the length L′ may safely be disregarded. Also the shape of the relative strength curves would seem to indicate that the above conclusion should be followed even when the ratio L/L' is greater than three. The second suggestion is not conclusive because the height of the blocks may affect materially the shape of the curves.

LOADS AT FAILURE, AND RATIOS P/P′

Mark	Size in Inches b	L or L′	d	Mix	Age in Days In Forms	In Damp Sand	In Air	Total	Consistency	Total Load at Failure in Pounds	Ratio $\frac{P}{P'}$
A4	4	4	8	1 cement, 2 sand, 3 gravel	1	54	2	57	Water flushed to top when well tamped	38,700	1 000
A6	4	6	8							43,500	1 124
A9	4	9	8							41,800	1 080
B4	4	4	8	1 cement, 2 sand, 3 gravel	1	53	2	56	Water flushed to top when well tamped and quaked slightly	25,200	1 000
B6	4	6	8							34,500	1 369
B9	4	9	8							33,100	1 313
C4	4	4	8	1 cement, 2 sand	2	51	1	54	Quaked freely when tamped	35,500	1 000
C6	4	6	8							39,900	1 124
C9	4	9	8							40,000	1 127
D4	4	4	8	1 cement, 2 sand	2	44	3	49	Quaked freely when tamped	49,900	1 000
D6	4	6	8							53,700	1 076
D9	4	9	8							49,400	0 990
E4	4	4	8	1 cement, 2 sand	2	37	3	42	Quaked freely when tamped	54,700	1 000
E6	4	6	8							60,000	1 097
E9	4	9	8							58,100	1 062

A fertile field of investigation is suggested in ascertaining the effect of eccentricity on the foundation itself, since dams, retaining walls and other structures in which the foundation is subjected to both direct stress and flexure form an important part of many engineering projects.

Thanks are due Clyde T. Morris, professor of structural engineering, Ohio State University, for the use of the testing machine and for valuable assistance.

Must Sell Bonds Before Letting Contract

The Court of Common Pleas of Erie County, Pennsylvania, decided Apr. 9 that the contract let in December, 1916, to Metz & Roth, for the construction of flood control work on Mill Creek at Erie, Penn., was not a legal contract because the finance commissioner had not certified to the contract. The third-class-city law of the state provides that money shall be appropriated and in hand before the finance commissioner can certify to a contract, and as only a portion of the amount of the money appropriated for this work was in hand in the form of cash, the remainder being in the form of unsold city bonds, the commissioner did not certify to the contract. The effect of this opinion, unless changed by the Supreme Court, is that the entire bond issue for a piece of public work must be sold before a contract can be let and the work started.

Purely Theoretic Superelevations Modified for Roads

Slight Distance, Ability To Stop, and Safety for Horses Will Limit Banking on Curves—Slower Speed Desirable

By W. S. Downs

Division Engineer, West Virginia State Road Commission, Morgantown

While a purely mathematical determination of the proper superelevation to be applied to a highway curve is not possible on account of the variety and nature of the traffic, the basic theory should be taken as the groundwork for practical modifications—such as those suggested by the necessity for a limitation of speed on account of short sight distances and the danger to horses inherent in a too great side slope. These modifications are in the interest of public safety. After some experiments the writer has developed a curve of superelevations for highways.

Theoretically, the amount of superelevation depends on both the degree or radius of the curve and the speed of the traffic. The theoretical formula is

$$e = \frac{v^2}{gR}$$

e = Superelevation in feet per foot width of road.
R = Radius of the curve in feet.
This formula may be expressed as

$$e = 0.0000117\ V_m\ D, \text{ where}$$

V = Velocity or speed of traffic in miles per hour.
D = The degree of curvature.

By plotting the results of this formula, using the abcissa to represent the degree of curvature and the ordinates the superelevation in fractions of a foot per foot width of road, the theoretical superelevation of the various highway curves for the different speeds can be taken from the accompanying plot. However, in the interest of public safety, all traffic laws require that the traffic slow down on approaching sharp curves, and while a speed of 35 miles per hour may be permissible on a straight roadway, no such speed can be tolerated on sharp curves because the limited sight distance makes it unsafe, regardless of the condition of the road surface or the extent of the superelevation. This is so self-evident as to be trite.

A commonsense rule, and one which has been incorporated in the road law of West Virginia, requires that no vehicle shall be driven at a greater rate of speed than will permit of bringing the vehicle to a full stop within half the actual sight distance at the place. This rule, of course, is somewhat indefinite as to the permissible speed of the vehicle, for the ability to stop quickly depends upon a number of variable and uncertain conditions, as for example, the smoothness and slipperiness of the surface of the roadway, the efficiency of the brakes, the character of the vehicle, the alertness of the driver, and other similar factors.

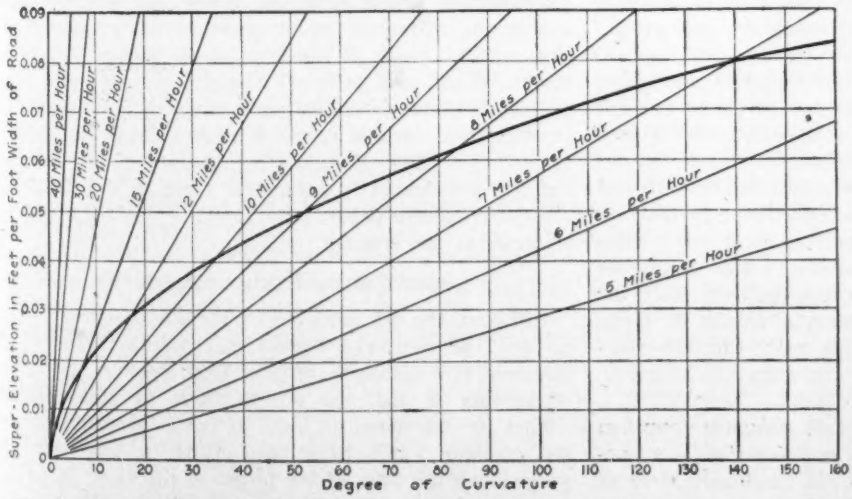
However, the higher the degree of curvature the less sight distance the driver has in which to detect the danger and stop the vehicle. The relative sight distances on different curves, based on a middle ordinate of 8 feet, is shown in the table:

2°—428 ft.	15°—156 ft.	40°—94 ft.	80°—65 ft.
5°—270 ft.	20°—135 ft.	50°—81 ft.	90°—62 ft.
8°—214 ft.	30°—110 ft.	60°—74 ft.	100°—57 ft.
10°—191 ft.	35°—100 ft.	70°—69 ft.	120°—53 ft.

If we assume that the average vehicle traveling at the rate of 10 miles per hour can be safely brought to a stop in a distance of 50 ft. on a comparatively slippery road, this speed would be safe on a 35° curve, inasmuch as half the sight distance is 50 feet. Moreover, the work necessary to stop a moving vechile is in direct proportion to the square of its velocity; or, with a given frictional resistance, the distance in which it may be stopped is in direct proportion to the square of its speed. Inversely, the safe speed of a vehicle on curves is in direct proportion to the square root of the sight distance.

Hence we may plot a curve of relative safe speeds for different curves. Such a curve is shown on the chart, and is based on the assumption that a vehicle traveling at the rate of 10 miles per hour can be safely brought to a stop within 50 ft. This assumption, of course, would vary under different conditions, but experience has shown it to be approximately correct under certain road conditions. In any case it offers a basis for relative safe speeds on the different curves, and therefore gives a basis for relative superelevations.

If the superelevation be greater than that indicated by the curve it would make the road unsafe for horse traffic on the curves of short radii, for experience has shown that when the superelevation exceeds 0.062 ft. (¾ in.) per ft. width of road, there is danger of the horses falling when the road is slippery.



CURVE IS BASED ON ASSUMPTION THAT VEHICLE TRAVELING 10 MILES PER HOUR CAN BE STOPPED WITHIN 50 FEET

An Engineering Council Now Almost Forgotten

Organized in 1886 To Promote an Improved System of Public Works—Ultimately Responsible for Board of Engineers for Rivers and Harbors

By F. H. Newell
Dean, Civil Engineering Department, University of Illinois, Urbana

THE Engineering Council recently created for consideration of matters of common concern to engineers calls to mind a previous effort the history of which has present value.

Thirty years ago the Council of Engineering Societies on National Public Works was formed, being the outgrowth of the efforts of many of the most notable engineers of recent times, some of whom are still living. It had for its immediate object two achievements: Better legislation in connection with public works, and the development of an engineering organization for constructing and operating such works.

The activities of various engineering societies which led up to this council—according to a statement prepared by the late E. L. Corthell—dated from 1874. At that time Congress authorized the President to appoint a mixed commission consisting of three civilians, three military officers and one member of the Coast Survey to examine and decide upon the question of the best method of opening the mouth of the Mississippi River. This commission decided in favor of the jetty system, a plan which was afterward carried out by James B. Eads.

In 1879 memorials were presented to Congress for the appointment of civil engineers upon the commission to have charge of the improvement of the Mississippi River. One of these petitions was signed by Thomas Doane, president of the Boston Society of Engineers, and concurred in by other well known men.

In 1880, at the twelfth annual convention of the American Society of Civil Engineers held at St. Louis, a resolution was adopted to appoint a committee to draft a memorial to Congress asking that the civil engineers of the country be placed in full charge of works carried on by the Government. The chairman of the committee in a circular letter dated April 5, 1885, suggested that a self-constituted committee take up the memorial and circulate for signatures.

This memorial was presented to Congress and called attention to the fact that the number of works in hand was greater than the number of experienced engineer officers and that "many of the most experiencd civil engineers in the country, who are well fitted by skill and education to take principal charge, are unwilling to accept such positions, where neither adequate emoluments or reputation can be hoped for." A large number of signatures were attached to this petition, such, for example, as that of Octave Chanute, James B. Eads, Alphonse Fteley, Desmond FitzGerald, Clemens Herschel, Charles D. Marx, George F. Swain and Alfred E. Burton.

On Dec. 3, 1885, duly accredited delegates from ten civil engineering societies held a convention at Cleveland pursuant to a call of the Civil Engineers' Club of that city. A report was adopted calling attention to the necessity for a better civil administration of public works and suggesting that Congress be asked to establish a suitable civil bureau.

During the next spring—on March 31, 1886—the societies again met in convention at Cleveland and a permanent organization was perfected under the title "Council of Engineering Societies on National Public Works" whose object was "to promote an improved system of national public works." Twenty-three societies were represented and to the memorial to Congress there were appended the signatures of several of the past presidents, vice-presidents and other prominent members of the American Society of Civil Engineers.

Engineering Societies Perfect Council on Public Works

An executive committee was constituted consisting of Lyman E. Cooley, president, John Eiseman, secretary, E. L. Corthell, Louis J. Barbot and Augustus Kurth. Topical committees were also constituted and their reports received by the executive board in the summer of 1887. A committee of the board was then appointed to digest the material, prepare a memorial and draft a bill.

The board presented its views to President Cleveland on Nov. 11, 1887, in accordance with his expressed interest in the matter. The bill finally prepared was placed in the hands of Hon. C. R. Breckinridge, who had given much attention to the subject, and as later revised was introduced in the Senate on Jan. 16, 1888, by Hon. Shelby M. Cullom, and referred to the Committee on Commerce, being known as S.1448. On the same day it was introduced in the House by Mr. Breckinridge as H. R. 4923, and referred to the committee on expenditures in the War Department.

On April 9, 1888, the Engineering Council through its executive board appeared before the Senate Committee and statements were made by the president of the council, Lyman E. Cooley, also by Messrs. Corthell, Kurth, Haupt and others. The proceedings with the proposed legislative memorials and various exhibits showing considerable research were printed as Senate Report No. 1848, Fifty-ninth Congress, first session, and are now bound in permanent form in Vol. 2525 of the Congressional papers to be found in the larger public libraries of the country.

Council Only Partly Successful

Although the bill prepared by the Engineering Council did not receive Congressional sanction, many of the important details were later acted upon in one form or another so that the efforts made by this council cannot be considered as lost. It is of interest to note the changes which have been made in the past 30 years along the lines of the proposed reforms. A brief reference to the points presented will enable a comprehension of the rate of progress. There is no doubt

that within the next few years—owing to the general upheaval caused by the great European war and to the greater public interest in national affairs—there will be accelerated development, especially as the engineering societies concern themselves more largely with the questions of large national importance.

The points made at that time by the late L. E. Cooley were as follows:

A. The following assumptions were made:

(1) The development of a system of harbors and waterways is desirable, and the Government is committed to this policy. (2) Legislative methods should be well defined, consistent and rational. (3) Present legislative and administrative methods are gravely defective, bringing down upon congressional and executive agents the severest public condemnation. (4) Every one appreciates the desirability of something different from present practice; divergence of opinion is confined to the nature of the remedies.

B. As a "statement of the case":

(1) A rational policy must not only provide a well adapted administrative system, but requires changes in the methods of legislation. (2) The work is essentially constructive and requires the service of a special professional class; economy demands that it be prosecuted continuously and rapidly. (3) All public works should be looked upon as part of a system. (4) As parts of a system every work should have its relative importance duly defined and be taken up in natural sequence. (5) These systems are defined by nature and show in the character of the streams.

C. With reference to legislation the following points were made:

(1) A corps of civil engineers should be regarded as a permanent establishment and regular provision made for its maintenance. (2) Appropriations for detailed surveys and examinations should be by large geographical areas and the allotment to the individual project be made according to executive discretion guided by immediate conditions. (3) Similarly all appropriations for repairs, maintenance, snagging and dredging should be by large divisions, later allotted to designated streams to be on the advice of qualified officers. (4) Appropriations for minor permanent improvements should be made in the same way. (5) Appropriations for capital improvements should be by single bill, and should provide for the completion of that work.

Failure of Existing System Outlined

D. Administrative evils were next presented under the following heads:

(1) The cost of supervision and personnel under the existing system cannot be closely determined, as it is paid from appropriations for the work. (2) The methods of disbursement and of administration are not in accordance with the special requirements of this work, but according to the rules of the army unsuited for economical and efficient civilian operations. (3) The works are in a large measure continually in the hands of green and inexperienced men or those unfamiliar with their charge. The army officers are not primarily educated for this work they are shifted rapidly and the more able civilians, because of underpayment and lack of recognition, leave government employment, the remaining force tending to mediocrity. The most important man in the office is the chief clerk. (4) There is virtually no inspection service or proper supervision. (5) The plans and estimates are without adequate examination and study by high authority. (6) The plans are not based on any system or do not take consideration of rivers as more than a local problem. (7) No judgment or discretion is lodged with the executive in regard to recommending or suggesting wise improvements or harmonizing different works as part of a system. (8) The military purpose of giving the officers a variety of experience predominates and civil knowledge is made subsidiary. (9) The service is mixed, anomalous and unjust; military officers and civilians cannot coöperate to best advantage. Civilians have no opportunity of being advanced to the higher positions. (10) No improvement is possible in the personnel except by making the entire service military from top to bottom or on the other hand entirely civil. (11) The service requires as highly specialized training as for military affairs and no civilized nation has found a military system best adapted to scientific and constructive work.

E. New organization was proposed under the following heads:

(1) A series of divisions based on the requirements of harbors and waterways in considering them as a system or parts of a system. (2) A system and requirements such as will secure the fullest deliberation and judgment before a project reaches Congress. (3) In executing work, responsibility and a full inspection service are provided. (4) It is made unlawful to expend money until some useful results commensurate with the expenditure can be vouchsafed. (5) The engineering corps in time to become entirely civilian with regular grades and promotion, partly by seniority and partly by merit. (6) The members of the corps to become skilled and experienced in all work they are called upon to supervise. (7) Entrance in this corps to be eligible to citizens of the United States, but the corps to be recruited largely from graduates of technical schools and military and naval academies. (8) Tenure during continuance of a high degree of competency and efficiency. (9) Positions such as to secure independence of judgment, free from dictation by superiors or pressure of influence. (10) The cost of administration for a given amount of work to be reduced.

F. In conclusion the following points are emphasized:

(1) The Government is committed to a policy of harbor and waterway development. (2) A consistent and businesslike policy should be adopted in making appropriations, a policy looking to the development of these improvements as a system. (3) An organization should be provided adapted to carrying out a definite policy with thorough system and economy.

Opposition to the Culom-Breckinridge bill was so pronounced that it failed. The chief arguments were those appealing to local pride and fear that the many smaller and less important schemes would be laid aside

in order to complete larger projects of national importance. The ostensible objection was that any new organization carrying out these reforms must be more expensive than the old and that there would result the creation of new officers and continually increasing outlay. The then chief of engineers, Gen. J. C. Duane, in his letter of April 12, 1888, stated that "it is doubtful whether any improvement in efficiency could be attained by a change in the present system." The economy he questioned, and called attention to the fact that a new organization would add to the cost "to which will be shortly added the expense of a civil retired list, which must before many years become a heavy charge against the Treasury," and that the expense of a proposed civilian corps will be excessive.

Change Opposed by General Duane

He was "of the opinion that the proposed change is not warranted either on the score of efficiency or economy." Moreover, the policy "if adopted by Congress will be of undoubted benefit to a few works to the exclusion of the great mass of them," and that "it is exceedingly questionable whether the interest of the country at large would be promoted by a change." He observes "that whatever changes or modifications Congress might deem it advisable to make can readily be effected with little or no additional expense under the present organization."

The discussion undoubtedly produced some good results and contributed largely to the activities which finally resulted in the creation in 1892 of the Board of Engineers for Rivers and Harbors—one of the most important steps in the improvement of internal affairs. In the larger matters of legislative policy and methods, less was achieved, although attempts were more and more persistently made to rectify or defeat the annual appropriation bill or to provide lump sum appropriations, as contrasted with the "pork barrel" distribution by Congress.

More or less desultory action or discussion was had by various engineering societies and organizations. The annual reports of the chief of engineers frequently noted the scarcity of engineer officers. The preliminary report of the Inland Waterways Commission transmitted by President Roosevelt to Congress on Feb. 26, 1908, called attention to general governmental inefficiency and the necessity of coördinating all bureaus; also to the desirability of maintaining an administrative agency under suitable legislative regulation with large powers for the investigation and elaboration of projects.

The National Waterways Commission in its final report of 1912 called attention to the numerous propositions "made for the creation of a board of public works or other body which shall decide upon the feasibility and desirability of proposed expenditures on rivers and harbors," emphasizing the necessity of increased membership of the Engineer Corps.

On March 1, 1910, the board of directors of the American Society of Civil Engineers: "heartily approve and endorse the action taken at a recent meeting of members of the society in appointing a committee consisting of Charles MacDonald, Alfred Noble, William H. Burr, F. P. Stearns and Samuel Whinery, with the object of urging suitable recognition of civilian engineers." This committee appeared before the Military Affairs Committee of the House of Representatives on March 9, 1910, and urged suitable amendments in the pending legislation. On Feb. 27, 1911, in Section 5 of the Rivers and Harbors act, there was inserted authority to detail for duty in charge of rivers and harbors or as members of the Board of Engineers any assistant (civilian) engineer in the employ of the engineering bureau of the War Department.

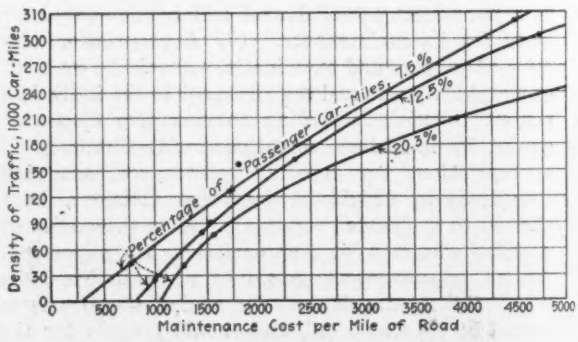
Moreover under the same act vacancies in the grade of second lieutenant in the Corps of Engineers may be filled from civil life by suitable examination of candidates between the ages of 21 and 29 holding a diploma showing graduation in an engineering school from an approved technical college.

Though reforms in legislative methods and executive control have moved slowly in the past, yet with the tremendous acceleration along all similar lines there is every reason to expect that wisely directed efforts on the part of the present Engineering Council may reach fruition in less time than in the past.

Railway Maintenance Cost Is Increased by Fast Passenger Trains

SPEED of trains affects the cost of maintenance of way and structures to the extent that the higher the proportion of passenger traffic, which may be assumed as high-speed traffic, the greater the cost of maintenance. This is the conclusion arrived at in a preliminary report presented by the track committee at the recent annual meeting of the American Railway Engineering Association.

In the accompanying diagram, the curved lines rep-



EFFECT OF PERCENTAGE OF PASSENGER-CAR-MILES

resent traffic of which the passenger-car miles constitute 7.5, 12.5 and 20.3% of the total car mileage. The vertical ordinates represent the annual cost of maintenance per mile of road; the horizontal lines represent the density of traffic in 1000 car-miles per mile of road.

It is recognized by the committee that the assumption of high-speed and low-speed traffic as synonymous with passenger and freight traffic is not entirely correct, but this, the committee says, offers the only opportunity for classifying expenses in accordance with differences of speed. The car-mile was taken as the unit for comparison on the ground that it gives the best measure of the facilities required by each class of traffic.

Columns Set Back of Walls Give Large Window Area

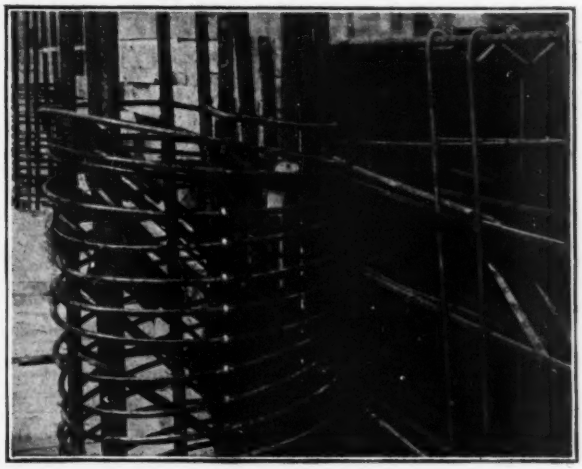
Lighting and Ventilation of Industrial Building Are Improved by Continuous Windows of Glass and Steel Sash

A SPECIAL detail in concrete building construction which is designed to give greater lighting area and better distribution of light in large industrial buildings consists in placing the outer columns inside of the property line. This permits of an uninterrupted stretch of curtain wall of steel sash and glass carried outside of the columns. This glass front may be supported on a concrete spandrel wall at each floor, or the spandrel may be omitted at certain floors so that the glass wall is continuous vertically as well as horizontally. The colums are of circular section like those of the interior panels.

The columns, slab and spandrel are formed integrally, and the slab is extended beyond the column to cover the entire area or to support the spandrel. This extension may be a simple cantilever, or it may be supported by brackets on the columns.

With this type of construction the window area in each wall of the building is equivalent to 88% of the total wall area, which means that only 12% of the outside light is lost on account of walls. It is also possible with this type of construction to omit the corner piers entirely, thus making the entire wall surface of glass. With ordinary construction, using outside piers, it is estimated that the amount of light lost because of walls varies from 50% to 25%. The continuous window area has another advantage in increasing the ventilating facilities. It is stated that with steel sash of present designs, and with this type of building, the ventilating surface of the windows can be increased more than 20%.

BUILDING IS WELL LIGHTED BY CONTINUOUS WINDOW AREA OUTSIDE OF WALL COLUMNS



REINFORCEMENT FOR WALL COLUMN AND SPANDREL WALL OUTSIDE OF COLUMN TO CARRY CONTINUOUS WINDOW OR GLASS FRONT

The first application of this construction was made in the 7-story and basement Winston Building erected in Chicago in 1917. This is a reinforced-concrete building 140 x 218 ft., of the loft type, intended for manufacturing and industrial purposes, and designed for a live-load of 300 lb. per sq.ft. Its flat-slab floors have a cantilever projection of 6 in. from the outer line of the column to the outer face of the spandrel wall. This gives a clearance of 3 in. between the column and the glass front. The corner columns and those next to the corners are of rectangular section and are built integrally with vertical sections of concrete wall on the property line. This arrangement is purely for architectural purposes in the design of the exterior of the building. The new method of construction here described has been invented and patented by Paul Gerhardt, architect, Chicago, who designed the Winston Building.

An unusual feature of this building is the manner in which the exterior concrete walls were finished. As soon as the forms were removed the green concrete surfaces were rubbed smooth with an electric surfacing machine, using steel wheels first and then carborundum stone. The walls were thoroughly washed with a stream of water from a hose to remove all dust. After a second washing a mortar of 1:1 sand and cement, having the consistency of a stiff paste, was applied to the concrete faces with a float and finished with fine hair brushes.

California Puts Idle Land to Work

Colonization in California is being pushed by the state on a 6000-acre tract, purchased recently, near Chico. The state proposes to provide the settler not only with land, but will erect simple modern houses, barns, silos and other necessary buildings, payments to be made on an installment plan with terms that may be met easily. One-third of the investment must be paid at the start, but 25 to 36 years' time is given to pay the balance. The prime requisite is a loyal, patriotic citizen not holding land in any other part of the state. Plans are made to invest at least $500,000 in the project at the start.

Grade and Standardize Personal Service in New Jersey

For First Time a State Has Put Into Effect Civil Service Procedure Worked With Success In Chicago

HEREAFTER civil service positions with the State of New Jersey with substantially similar duties and responsibilities will be given identical titles and compensation. In addition, acts recently passed by the legislature provide for the establishment of standard specifications for duties, responsibilities and qualifications in the counties and municipalities which have adopted the provisions of the civil service act. The bills, which were introduced Jan. 8, 1917, were framed in accordance with a report on the subject by J. L. Jacobs & Co., consulting engineers, Chicago, made after studying for six months the present system of employment, compensation and promotion with heads of departments. From this report the following is taken:

The primary objects of the plan are to provide systematic, uniform and fair means of employment control, which will aid the Governor, the state legislature and the state administrative officials in the judicious apportionment and uniform control of moneys appropriated for compensation, and make possible the application of positive and businesslike employment methods in the state service.

Beneficial Effect of Plan

The application of these definite and systematic employment standards, in such a way as to have them well understood throughout the state civil service, will have the effect, Mr. Jacobs holds, of (1) stabilizing employment within departments, (2) reducing labor turnover, (3) increasing the attractiveness of public service to a high grade of workers, and (4) increasing the workers' incentive for efficient service.

In conducting the study and in preparing the standardization plan, definite and established methods were followed in obtaining complete and well supported information in connection with present employment methods, hours of work, vacations and other leaves, present organization and the duties and responsibilities of all positions. Combined with the analysis of these vital state employment matters, inquiries were made into rates of compensation and other employment conditions in the public service of a number of the New Jersey cities and counties and in private industrial and mercantile concerns in different parts of the state. The data were collected through these means and with the aid of the bureau of industrial statistics of the department of labor, through which bureau information on employment conditions from more than 70 additional private concerns was obtained.

Study of the cost of living and employment and labor conditions in different parts of the state showed that a uniform salary rate for the entire state would not be equitable nor practicable. Persons who live in that section of the state across the river from and to the west and northwest of the City of New York are subjected to higher living costs and have easy access to the City of New York, where higher wages are the rule. Provision, therefore, has been made in the standardization plan not only for the higher cost of living in this district but also to some extent to offset any temptation to leave the state service due to the higher rates paid in the metropolis.

Under the existing system there are 3462 positions of which 2568 are in the classified service with 911 distinct grade titles. These titles will be reduced 50%.

Since June, 1917, when this study was begun, there have been numerous changes in the salaries of employes filling positions in the classified civil service and the aggregate total at this time has been increased by a considerable amount. These increases have been made without reference to any uniform or equitable plan. Necessity for qualification and definite regulation of salary advancements and uniform employment control as provided in the standardization plan and regulations presented is further emphasized.

Considering the service as of June, 1917, and taking into account the seniority of present employes, the present annual turnover of civil service employment, which is estimated at between 15% and 20% (other than attendants and laborers, in which cases it is more than 90%), the accruals resulting through the requirement that entrance shall be at the minimum salary rate in each position and the rapidity of advancement to higher salary rates as provided in the proposed plan, the aggregate change in dollars and cents is estimated at less than 2%, or about $3900 monthly for the entire classified civil service of the state.

The engineering service includes those offices and positions in the classified civil service whose incumbents are required to perform technical engineering work for which training and experience in civil, mechanical, electrical, sanitary, chemical, architectural or other specialized professional engineering branches are required, and which does not include work covered in any other service definition.

Salaries in Engineering Service

Salaries fixed in the various grades are as follows:

Grade I, draftsmen and rodmen, $70 to $90; Grade II, engineering draftsmen, junior appraisal engineers, junior engineer and junior sanitary engineer, $100 to $135; Grade III, architectural draftsmen and designers, assistant appraisal engineers, assistant civil and sanitary engineers, bridge draftsmen and designers, chief topographical draftsmen, $140 to $170; Grade IV, assistant division highway engineer, chief (bureau of sanitary engineering inspection), senior civil engineer, senior electrical appraisal engineer, senior engineer (gas plants), $180 to $225; Grade V, assistant chief engineer (bureau of utilities) $225 to $275; assistant chief engineer (commerce and navigation) $10 and up per day; division highway engineer, $235 to $275; Grade VI, chief engineers of the bureau of utilities, division of bridges and grade crossings and taxes and assessments, $350 and up, consulting engineers the same, or $10 and up per day; engineer of boundary line monuments, $10 and up per day. For the metropolitan district, including Newark, Jersey City, Hoboken, Paterson, Morris Plains, Montclair and Kearny, the above basic rates are increased in Grades I and II by $10, in Grades III and IV by $15.

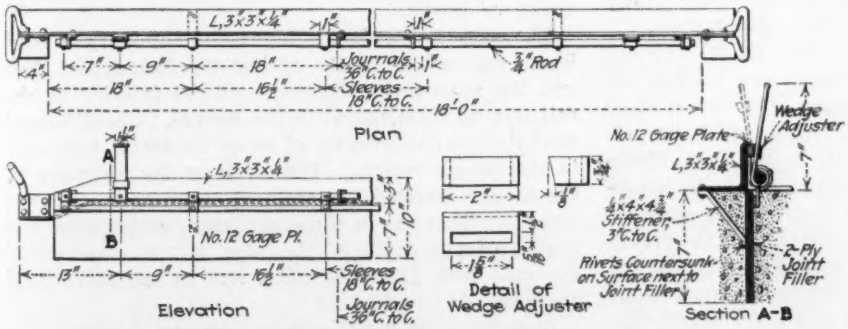
Expansion-Joint Installer Insures Proper Placing

Filling Material Held Securely by Adjustable Clamping-Bar—Weighs 140 Pounds for 18-Foot Roadway

By Ira R. Browning
Engineer, State Road Commission of Utah, Salt Lake City

After several attempts to obtain a satisfactory expansion-joint installer for concrete road work in Utah, the device shown in the accompanying sketch was finally adopted. It consists essentially of a steel plate 8 in. wide, and of length according to the desired width of pavement. This plate is stiffened by a 3 x 3 x ¼ in. angle and occasional braces riveted from the lower leg of the angle to the center of the unsupported portion of the steel plate. The opposite side of this steel plate is left smooth, and against this surface the double-ply joint-filler is placed and held by a clamping-bar. The position of the wedge-adjuster may be altered by releasing the setscrews and revolving the lever to any desired angle. In the illustration the dotted lines show the position of the clamp when the wedge has been raised for releasing or inserting the joint-filler.

As the standard road section for concrete pavement in Utah has an 8 in. thickness of concrete at the center, reducing to a 6 in. thickness at the edges, the stiffener angle is offset downward 2 in. so that it may rest upon the 6-in. channel forms at the edges of the pavement.



STIFFENER ANGLES OFFSET DOWNWARD SO THAT INSTALLER MAY REST ON STEEL SIDE FORMS

The surface of the steel plate is maintained in a vertical plane and the lateral stress due to tamping the concrete is resisted by three or four steel pins driven into the subgrade at the side of the joint-installer. After sufficient concrete has been placed and tamped against the joint-filler the wedge is raised to release the clamp, the steel pins are withdrawn from the subgrade and the steel form is lifted clear of the concrete.

No difficulty will be experienced in removing the steel plate when it has been promptly cleaned after the previous removal; but if the cleaning is neglected there will be a tendency to drag and tear, or disturb, the joint-filler.

The device as used for an 18-ft. roadway weighs approximately 140 lb. and has proved eminently satisfactory. As the subgrade is level, and the concrete pavement is crowned at the center, the 8 in. strip of joint-filler extends above the concrete at the edges of the pavement. After the concrete has been cured for two weeks under water, the protruding joint-filler is easily trimmed off with shovels while the earth levees are being removed.

Contract System for Ballasting Track Disapproved by Engineers

That track ballasting by contract is inadvisable, especially on lines under operation, is the conclusion arrived at by the committee on ballast and presented with its report at the recent annual meeting of the American Railway Engineering Association held in Chicago.

Inquiry was made of more than 100 railways. The contract system was favored by 9 out of 18 railways which have employed this method on new construction, and by two out of six railways which have employed it on lines under operation. Of 86 and 87 roads which have not used the method under these two conditions, only 13 and 8 respectively were in favor of trying it.

Two advantages are assigned to the contract system: (1) Flexibility of supply and control of labor owing to freedom in fixing rates of pay; (2) possibility of a low cost where lack of proper equipment would make the work expensive if done by company forces. Disadvantages comprise loss of control over the work; less thoroughness even under close inspection; possible increase in ultimate cost and disputes over the work. On operated lines there are the additional disadvantages of difficulty of insuring proper maintenance of surface, less complete coördination between the constructing and operating forces, some added danger due to loss of direct control, greater interruptions to traffic and claims for extras on account of interruptions to the work.

According to the report, those who advocate the contract system do so largely as an emergency measure because of the greater flexibility of a contractor's organization in changing the rates of pay and so securing labor in time of stress. The committee considers that the matter is best summed up in the following remark that was made by one of the engineers favorable to the system:

"My experience is that contract ballasting is to a large extent a necessary evil."

Successful experience with the contract system as a part of the maintenance-of-way work on operated lines of the Missouri Pacific Ry. was described in *Engineering News* of May 4, 1916, page 828. In this case there was a marked saving in cost as compared with work by company forces, and objections advanced by the operating and maintenance departments proved to be without good foundation. The method was abandoned, however, the abandonment being due to a reorganization of the railway.

Steel from Nickel-Copper-Iron Ore Shows High Strength

Copper Replaces Part of Nickel In "Nicu" Steel Made by Smelting of Sudbury Ores—Low Production Costs

LARGE-SCALE experiments to produce a high-strength steel from the Sudbury ores, in which both copper and nickel are combined with the iron, show that a metal giving test results quite equal to those of nickel steel as used for bridges and for forgings can be produced at low cost. The new product has been named "Nicu" steel and is to be made by the Nicu Steel Corporation. Material of ultimate strength 70,000 to more than 100,000 lb. per sq.in., yield-point 50,000 to 80,000 lb. per sq.in., and satisfactory ductility for bridge or ordnance purposes, is produced at costs which may be brought down as low as $30 to $35 per ton. Figures of tests on the material produced in the experimental smelting are given by Lieut. Col. R. W. Leonard in a paper read before the Canadian Society of Civil Engineers, March 28.

Direct smelting of nickel-bearing iron ores to nickel-iron pig has been done in the past. With the same purpose of producing a copper-free nickel alloy, much study has been put upon the Lake Superior nickel-copper-iron ores to produce nickel pig and nickel steel with minimum admixture of copper. On the other hand, nickel-copper steel has been made in the United States in several instances by adding monel metal to steel.

In the development of "Nicu" steel G. M. Colvocoresses made the original experiments and worked out processes for smelting the Sudbury ores or the slags which are now wasted in that district, and took out patents on the processes. Subsequently he and H. A. Morin smelted 200 tons of ore and 40 tons of slag in an improvised plant at East Montreal. After roasting, smelting with lime flux in an electric furnace performs the principal reduction, furnishing a pig iron of homogeneous composition; this was refined to medium-carbon steel partly in an electric furnace and partly in an openhearth furnace using producer gas. In the work at East Montreal the average charge in the smelting furnace was 1400 lb. of roasted ore, 525 lb. of burned lime, and 375 lb. of coke breeze or coal. The average analysis of the weathered ore received was: Iron 46%, nickel 1.3%, copper 0.28%, silica 19.9%, alumina 3.8%, sulphur 1.5 to 3%, lime 2.7%, magnesia, 1.3%. The pig iron produced averaged as follows: Sulphur 0.09%, phosphorus 0.07%, manganese 0.18%, silicon 1.75%, carbon 3%, nickel 2.20%, copper 0.40%. This shows a high degree of purification under the action of the lime.

The company believes that equally satisfactory results can be obtained by smelting in an ordinary blast furnace after roasting the ore to about 1½% sulphur and then nodulizing in rotary kilns.

In ten of the heats run at East Montreal, steel was produced having carbon content from 0.17 to 0.73%, silicon from 0.012 to 0.032%, sulphur always below 0.048%, phosphorus generally below 0.01%. The sum of nickel and copper ranged from 1¼ to 2½%, copper usually being about one-fifth of the total.

A typical strength test, one made by Dr. Alfred Stansfield of McGill University, Montreal, resulted in a tensile strength of 96,500 lb. per sq.in., a yield point of 52,800, an elongation (in two inches) of 24.3%, a reduction of area of 50.8%, and a 180° bend test flat without cracking. This was a specimen of "Nicu" steel in which the combined nickel and copper was 2.26%. For comparison it may be noted that 3½% nickel steel is commonly specified to have an elastic limit not below 50,000 lb. per sq.in. and an ultimate strength of 85,000 to 100,000 lb. per sq.in., with an elongation of 16 to 17% in 8 in., and a reduction in area greater than 30 per cent.

Colonel Leonard says that "Nicu" steel has not as yet been manufactured on a commercial scale.

High Cooling and Rolling Stresses Found in Steel Rails

STRESSES of 18,000 to 20,000 lb. per sq.in. exist in steel rails when no load is on the track, according to a summary of the rail-stress question given by J. E. Howard of the Interstate Commerce Commission before the New England Railroad Club on Jan. 8, 1918. These statements evidently are based on the many measurements of such stresses which have been made in the safety investigations of the commission during the past five or six years. The stresses in question include those developed by the cooling of the rail on the hotbed after the last pass in the rolling mill, and those resulting from the distortion of the metal through the rolling action of traffic.

The cooling stresses are highest in thin-flanged rails. While the rail is on the hotbed the flanges cool first and the subsequent shrinkage of the interior of the rail sets up compression in the flanges. Under normal conditions a compression of about 18,000 lb. per sq.in. in the flanges results. The metal at the periphery of the head is usually in a state of compression of lower amount. Tension, on the other hand, occurs along the middle of the width of the base, at the junctions of the web with base and head, and in the interior of the head.

Gagging introduced other stresses locally. Mr. Howard does not consider it to be a seriously injurious process, however: "Anxiety should not attach to the effects of treatment which practically every rail is submitted to. If gagging is held to be seriously detrimental to rails of current manufacture, there is lack of justification in procuring rails under present specifications."

The rolling strains developed in the track change the initial stresses of the rail profoundly, at least in the head of the rail. Every rail in service is subject to this effect. The skin of metal along the top of the head frequently acquires a permanent longitudinal compression of 20,000 lb. per sq.in., and the stress here produced may be greater for light wheels than for heavy wheels, because the effect of the latter penetrates deeper into the metal of the rail head. The metal of the web is little affected by the rolling influence, though it is subject to the mechanical production of permanent strains around the bolt hole, due to the hammering action at the side of the bolt. Under ordinary conditions the base of the rail also is little affected.

Human Problem Thought of Paramount Importance in Paris Shrapnel Plant

Health of 6000 Women Employees in Total of 9000 Studiously Safeguarded, and Provisions Made for Care of Their Infants—Excellent Meals Served at or Below Cost in Large Dining Hall

By Robert K. Tomlin, Jr.
War Correspondent of "Engineering News-Record"

IF YOU had been in Paris three years ago and had decided, in a whimsical mood, to leave the beaten track of the tourist sightseer and visit the most commonplace and uninteresting spot in the whole city, you could not have selected a better objective than the strip of land which flanks the River Seine in the western outskirts of the town, known as the Quai de Javel. A few rickety buildings of the typical "shanty" type, a machine shop or two, and here and there patches of ground devoted to truck gardening—these would have been the sights to reward you for your trip. But all this was three years ago. That spot has since undergone an almost magical transformation. Acres of long, low buildings have sprouted upon it, railroad cars and motor trucks are busy delivering to and taking away from it huge volumes of materials, men and women by the thousands come and go daily, and the steady hum of machinery continues day and night. And all of this activity is the result of a man with a purpose. In the early days of the war André Citroen decided to manufacture artillery munitions. He chose the Quai de Javel as the site for his plant. Ground for the foundations of his shops was broken in March, 1915, and four months later—in July—buildings were erected, machinery installed and finished shells were actually being shipped to the front for use by the famous French "soixante-quinzes," "75s."

But this was only the beginning of things. Citroen is not the kind of man who is content to do things on a small scale. Starting with a daily output of 10,000 shells, the plant capacity was soon increased to 20,000: in 1916 the output was again doubled, and today the enlarged works are delivering the stupendous quantity of more than 50,000 shells every day. Along with this achievement other things have happened. War's draft upon the manhood of France has made the manufacture of munitions largely woman's work, thereby introducing into the industrial problem entirely new elements. Obviously, old precedents had to be discarded and new conceptions of machine shop administration formed. To this task Citroen applied himself with characteristic energy, individuality and thoroughness, and created a new order of things in French industrial life, the workings of which I was permitted to observe during a recent tour of the plant. The outstanding impression which I carried away was this: In organizing the work of producing 50,000 shells day after day at the Citroen plant, the human problem—the problem of the worker as a woman or a man—has received fully as much attention by the executive heads of the company as has the problem of machines and materials.

My visit to the great munition-producing center was arranged through the French "Maison de la Presse," and of course credentials of one sort or another had to be viséd before the necessary permits to enter the works could be obtained. It was Thursday, "visitor's day," and in our party of inspection was George Randolph Chester, creator of "Get-Rich-Quick Wallingford," his wife, a French lady who is a specialist in social welfare work, a Spanish journalist and one or two others besides myself.

DINING HALL WHERE 2700 EMPLOYEES CAN BE SEATED AT ONCE
Note the ever-present electric truck on the right

We began our tour through the executive offices, first visiting the library in which 100,000 volumes are available for the use of the company's employees. Then we passed through the chemical, metallurgical and testing laboratories, all equipped with the most up-to-date apparatus. Noon found us at luncheon in the *cantine*, or huge dining hall, which seats 2700 employees at one time. After we

QUARTERS FOR THE CARE OF INFANTS OF WORKING MOTHERS

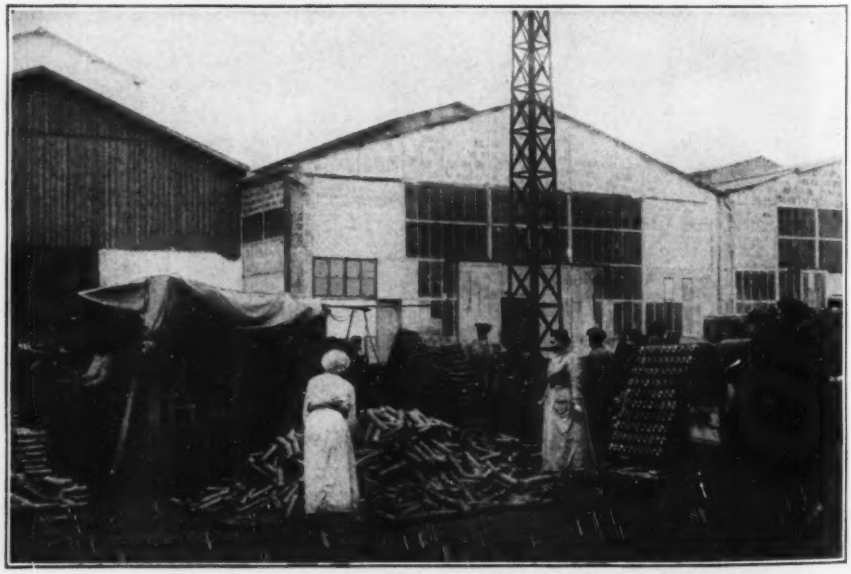
had finished our meal we made the tour of the various shops, and ended by inspecting the welfare institutions which form an important part of the administrative scheme of the works. Our guide during the day was the company's dentist, a French Army officer, who had formerly been a student at the University of Pennsylvania. Readers of *Engineering News-Record* will not be interested in the details of the process of shell manufacture, but should be in what we may call the human side of the institution—and it is an institution.

At the time of my visit the employees numbered about 9000, and of this number 6000 were women. The work is conducted in two shifts of about 10 hours each. The day shift of 6000 employees comes on at 7 a.m.; stops at noon for *dejeuner* (lunch); resumes work at 1:30 p.m., and continues until 6:30 p.m. The hours for the night shift (3000 employees), are from 7:30 p.m. to midnight, and from 12:45 a.m. to 6 a.m. About one-third of the employees live in the immediate vicinity of the works and arrive and depart on foot. For the others there are adequate transportation facilities, as the Qual de Javel station of the "Metro" (the Paris subway) is only a few minutes walk from the shops, and street-car lines are also within easy reach.

After an applicant for employment has been examined by a superintendent he is assigned to a shop and receives a time card, a service card, a card indicating the name and location of his particular shop, the name of his foreman, locker number and the number of the timeclock on which he checks in and out. By the system which has been developed a man can be set to work in a few minutes. After six months at the same kind of work an employee, on request, is assigned to different duties.

Two systems of wages are in force—payment by piecework and by time. On time work all employees performing the same kind of duties generally receive the same wages, but in some cases bonuses are paid, depending on the diligence and capacity of the worker. Whereever possible, however, payment is made on the piecework basis. To save time in paying off the workers the following scheme has been developed. Only even sums of money are given out, irrespective of the actual amount which has been earned. The balance is credited and issued on the next payday. Payment is made fortnightly from about 100 windows, and from each window sums of only one amount are issued. For example, there will be a window at which sums of 70 francs—and only 70 francs—are paid; another for 80 francs; another for 90 francs; another for 100 francs, and so on upward. In order to receive their wages employees must present vouchers. To aid in still further simplifying the procedure, payment cards of various colors are used, and the corresponding colors are painted on the pay windows. A bureau for adjusting complaints is open continuously.

General or special announcements to the force are made either in the form of printed sheets or (at night)



TRUCK REMOVING SHELL FORGINGS FROM AN INSPECTION POINT

of illuminated signs over the shop exits. A service for investigating absences from work, by means of visits to the homes of employees, also has been organized.

Very elaborate measures have been taken to safeguard the health of employees. They assume two forms; prevention and cure. On the side of prevention frequent lectures on sanitation and the care of the human body are given, there being special conferences at which female ailments are discussed. Care of the teeth is considered so important that the plant employs regularly a staff of dentists, and has provided them with offices equipped with every modern dental appliance. At the dental rooms 100 patients can be treated every day. Printed bulletins on the care of the teeth are issued regularly. Of course there is also an infirmary with doctors, both male and female, in constant attendance.

One of the most spectacular things which Monsieur Citroen has developed is his *cantine*. I had the pleasure of eating luncheon in this mammoth hall, receiving the same fare as the workers. And a mighty good meal it was—*hors d'oeuvres*, bread, roast lamb, beans, red wine, baked apples and coffee. This meal, without the wine, costs the employees 1.50 francs (26½c. at the present rate of exchange on French money), but I was informed that the company loses about 1 franc per head at this rate. The food is cooked in a large, well equipped kitchen and is delivered by means of electric trucks to warming ovens at the ends of the transverse aisles in the hall. It must be remembered that the job of feeding 2700 people in one hall involves the transport of food rather long distances, and unless mechanical means were employed the service would be slow and the dishes cold.

TUBE-DRAWING SHOP FOR SALVAGING REJECTED SHELL BODIES

Men and women eat together at the same tables, and the meal is much more prolonged than would be the case with American mechanics. An hour and three-quarters is allowed for luncheon. With the French this meal is a leisurely occasion, and this characteristic was well exemplified at the *cantine*. There is no bolting of food. It is eaten slowly, between sips of wine, which is supplied at a small extra charge. Another point is that service by uniformed waitresses is provided and that dishes of meat and vegetables are passed to each individual so that taste as to the size of the helping can be satisfied.

Adjoining the *cantine* is a clubroom, where the employees, men and women, can spend what remains of the luncheon "hour." I saw the men here playing billiards and chess and the women in groups talking, knitting or playing games. This luncheon "hour" forms a decided break in the day's work, and offers means of complete relaxation. Whether or not it is his usual custom I do not know, but on the day I visited the plant M. Citroen himself ate at the table adjoining ours in the *cantine*.

In works where so many women are employed the matter of childbirth presents a rather important problem, which resolves itself into two main subdivisions—the woman about to become a mother, and the newly born infant. With the probable increase of woman labor in United States machine shops this question is one which American executives cannot dismiss lightly. Here is the way the situation is dealt with at the Citroen plant. The prospective mother receives 30 francs a month in addition to her regular wages, and must visit the company's doctor twice a month. When her condition becomes such as to prevent her from performing her regular duties in the shops she is sent to a hospital, where all of her expenses are defrayed by the company. After giving birth to the child the woman is sent to rest quarters, where she remains six weeks before returning to work.

For the newly born infants the company has a special building, called the *pouponnière*. Here the children remain day and night, if the parents so desire, under the care of competent nurses. The mother calls for her baby on Saturday, takes it home over Sunday and returns it to the *pouponnière* when she comes back to work Monday morning. During the regular hours of shopwork each mother is allowed two periods for visiting and nursing her child, while additional visits are made before and after hours and after luncheon.

I was taken through the *pouponnière*. It is light and warm, finished inside with white and blue tile, and is kept scrupulously clean. Every one of the 30 cribs in the ward through which I passed was occupied by a healthy looking infant. M. Citroen, however, is going one step farther than the *pouponnière*. He is now building a *garderie*—a building to which the children from the *pouponnière* will be transferred when they have begun to develop. As an indication of the detail into which this man goes when he undertakes anything, he has purchased a large consignment of puppy dogs for the children in the *garderie* to play with. This institution will be large enough to house at one time 150 sons and daughters of the plant's employees.

Various educational and amusement facilities are furnished to the men and women who are turning out shells at this plant for the French Army's 75 mm. field pieces. Every Saturday night in the huge *cantine*, or dining hall, a moving-picture program is given. Seats are provided for 3500 workers and members of their families. There has been organized among the employees a band of 60 instruments, which gives concerts on these evenings. On Christmas and other holidays special programs of entertainment are arranged.

In fact, the features other than those directly connected with the manufacture of shells are almost endless. A coöperative store, where goods and food are bought in bulk and sold practically at cost; classes in English, physics, mechanics and metallurgy; a legal-aid department; a social club, a company newspaper, and a library are a few of the special activities.

As we finished our tour of the works and were about to depart, I turned to our guide. "What will become of this institution," I said, "with its thousands of employees and thousands of machines, after the war, when France will not need 50,000 shrapnel a day? I suppose there will be a wholesale lay-off of workers." He smiled. "On the day peace is declared," he replied, "M. Citroen will have completed plans for taking on 10,000 new men from the returning armies. From shrapnel we intend to transform our plant output into automobiles and agricultural implements."

Standard Reversed Curve for Jogs in Main Highways

Illinois Adopts Design for Improved Roads at Points Where Section-Corner Corrections Make Dangerous Offsets

By C. M. Hathaway

Assistant Road Engineer, Illinois State Division of Highways, Springfield

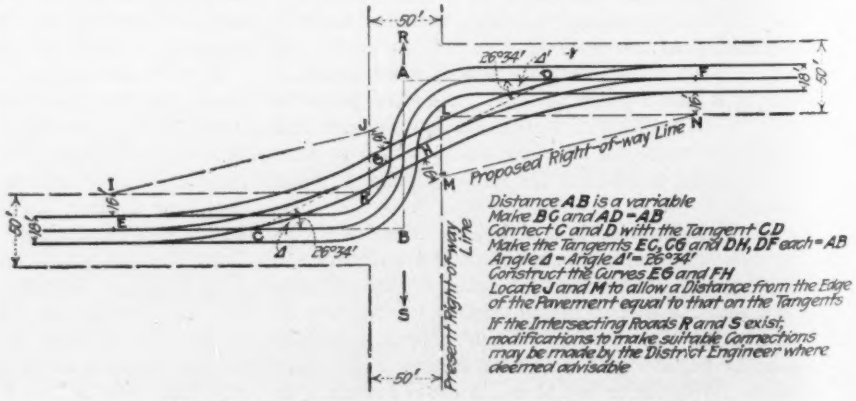
A STANDARD design for sharp reversed curves on main traffic ways has recently been adopted by the Illinois State Division of Highways. Except where limited by topographic conditions, the road system of the state follows the section lines. Because of earth curvature the range lines, bearing due north, were constantly convergent and required a correction to maintain the full six-mile length on the east and west township lines. Rather than make adjustment at each section corner, however, the corrections were made at certain definite intervals and errors in bearing and chaining were also made at the same place. Consequently, pronounced "jogs" in the range lines are apparent at these points. The east and west township lines were similarly corrected for errors in bearing and chaining, as shown by numerous offset.

That this fact alone constitutes the need of a design to overcome the resulting sharp turns at such points is seen by the fact that in a system of 100 miles of north and south road six or eight such jogs may be anticipated, while on an equal length of east and west road three or four may be encountered. Topography and the tendency to follow the "line of least resistance" may be further counted on to provide an additional number of unsightly and dangerous reversed curves. The necessity for a standard design was the result of the contemplated state-wide system of highways and the recent marked increase in the volume and speed of traffic. These same forces had produced designs for methods of lengthening out curves at 90° turns which were described in *Engineering News* of Nov. 9, 1916, p. 874, and in *Engineering News-Record* of July 19, 1917, p. 134. In the case under consideration the layout is very simple and is designed to fit any offset length, as *A-B*, for example. The tangent distances governing the new tangent *C-D* and the tangents to the curves *EG* and *FH* are always equal to *A-B*. The angles Δ and Δ′ are constant, and the radii of the curves *EG* and *FH* are thus readily determinable.

The new right-of-way lines *IJ* and *MN* are so located that on the two curves *EG* and *FH* the same minimum distance to the inner edge of the pavement will be maintained as on the original tangents.

As a field inspection would be necessary to work out the details for any particular case, no attempt has been made to set limits within which this design may be used. Topography, value of land needed for right of way, and the necessity for connections with the intersecting roads, would constitute a limitation on maximum values of *A-B*, while with minimum values a tangent similar to *C-D* might easily be run in so that the angles Δ and Δ′ would not exceed 10° and the curves *EG* and *FH* might then be omitted. From a general knowledge of the Illinois road system, however, the usual length of offset commonly encountered where the elimination of the reversed curve would be feasible might be safely estimated from 25 ft. to 150 or 200 feet.

Considering a typical case where *A-B* equals 100 ft., it will be found that the saving of pavement along the new line *E-F* is 80 sq.yd. Estimating concrete at



DESIGN CAN BE MODIFIED TO MEET SPECIAL CONDITIONS

$1.70 and brick at $2.20 per sq.yd., the saving on pavement would be $136 for concrete and $176 for brick. The new right of way required on both sides is only 0.16 acres, and allowing $300 per acre for land, the total cost for this item would not exceed $50. There results a net saving of $86 or $126 in construction cost, an easy riding curve pleasing to the eye is obtained, and primarily the dangerous hedge fence or corn row, always an obstruction to the vision of the driver, is no longer a menace to traffic and a limitation to reasonable speed.

Lengthening the line of clear sight on a turn is always the paramount issue and it will be noted that, for values of *A-B* from 0 to 25 ft., there could be no obstruction to the line of clear sight since the center line of each tangent is on a line with one right-of-way line of the other tangent. For higher values of *A-B* the clear sight is at least as long as the new line *E-F* and constantly increases with *A-B*. It should also be noted that in actual practice the area of right of way actually required could be lessened appreciably and still give ample ditch room on the inner sides of the two curves without materially affecting the line of clear sight.

Provision for suitable turns into the intersecting roads *R* and *S* would suggest modifications of this design not shown on the drawing. In Illinois the roads intersecting the average main highway are by a large majority small "feeders" leading back into agricultural territory. Such roads must reman unimproved for years, and should therefore receive no especial consideration in influencing the proposed alignment of the main road. When the intersecting roads equal the main road in importance, or when this is even a future possibility, provision for suitable connections should be taken into account in the design of the proposed improvement. Only in such cases, then, must the above design be either extensively modified or entirely disregarded.

Taking into consideration the relatively few instances where such a modification would be needed and realizing that local conditions would further modify any fixed rule, it is not considered advisable here to enter into a discussion of the numerous details of such a design. It could best be handled as a special case by the district engineer when working up plans. Details based upon variations from the standard design, as influenced by local conditions and details of construction, are also properly left to the judgment of the district engineer, to be worked out in accordance with the usual practice of the department.

California Puts Idle Land to Work

Colonization in California is being pushed by the state on a 6000-acre tract, purchased recently, near Chico. The state proposes to provide the settler not only with land, but will erect simple modern houses, barns, silos and other necessary buildings, payments to be made on an installment plan with terms that may be met easily. One-third of the investment must be paid at the start, but 25 to 36 years' time is given to pay the balance. The prime requisite is a loyal, patriotic citizen not holding land in any other part of the state. Plans are made to invest at least $500.000 in the project at the start.

Wooden Floors on Highway Bridges Are Now Obsolete

Modern Motor-Truck Loadings Overtax the Stringers —Fire in Floor Planking Likely To Destroy the Trusses

By J. A. L. Waddell
Consulting Engineer, Kansas City, Mo.

WOODEN floors for highway bridges today ought to be considered a construction of the past. No modern bridge engineer should be guilty of designing or building any more of them.

There are three good reasons for this statement: First, the ordinary plank floor supported on wooden joists is not strong enough to carry with safety the heavy, concentrated live-loads produced by rapidly-moving auto-trucks. Second, the danger from fire is so great that it does not pay to submit the entire superstructure to the chance of destruction by the burning of the timber in the deck. Third, the up-keep of a wooden floor is far higher than that of a paved floor on a concrete base; and the difference in the future will steadily increase, because the cost of timber will rise with its augmenting scarcity. Again, as the price increases the quality decreases, owing to the fact that the good timber is used up first, leaving the lower-grade material for future consumption.

Let us take a few cases of ordinary timber floors and find how high the joists are stressed by bending under modern motor-truck loads.

The best tables of wooden joists for highway bridges that I know of are those given in my first book, "The Designing of Ordinary Iron Highway Bridges," published by the Wileys in 1884. In spite of its antiquity, that treatise provides stronger joists than it is customary today among county highway bridge builders to employ in their constructions. Tables XV and XVI of that book give the number and sizes of pine joists for different live-loads—Class A for cities, Class B for suburban districts, and Class C for country roads—summarized herewith in Table I.

Three Types of Motor-Truck Loadings

Referring to page 118 of my "Bridge Engineering," we find three types of motor-truck loadings given as standard, that is, 18-ton, 12-ton, and 6-ton (the figures are loaded weights). The first is so unusually heavy that it may be ignored in this investigation; but the second is common in cities and their vicinity, and the third is so light that it may be deemed the very lowest legitimate standard for country dstricts, because the road-building trucks in common use throughout the western states, without any overload, bring a concentration of 6000 lb. on each rear wheel. Such being the case, it will be well to adopt the 12-ton truck for Class B floors and the 9-ton truck for Class C floors when making the test under consideration.

In the 12-ton truck each front wheel carries 3000 lb. and each rear wheel 9000 lb., the corresponding loads for the 6-ton truck being 2000 lb. and 4000 lb., and those for the road-building truck 3000 lb. and 6000 lb. In all three trucks the distance between central planes of wheels is 6 ft. and that between axles 12 ft.

In Fig. 7e on page 131 of "Bridge Engineering" the impact for a 20-ft. roadway is shown to run from 46% for 16-ft. panels to 44% for 24-ft. panels, hence we can use for all panel-lengths an average of 45%.

In relation to the distribution of wheel loads on joists, it is fair to assume that, when the wheel comes directly over a joist, that joist will carry one-half and each of the two adjacent joists one-quarter, while when the wheel comes midway between two joists its total load will be equally distributed between them. The thickness of the flooring is so small and its condition is so uncertain that it cannot be counted upon to distribute any concentrated load over more than three joists. On this basis the center live-load for each joist will be 4500 lb. for the Class B structure and 3000 lb. for the Class C structure. Adding the impact makes the grand-total center live-load 6500 lb. for Class B and 4300 lb. for Class C.

Computing herefrom the bending moment, and adding the dead-load bending moment, which in no case exceeds 10%, we have the results given in Table II.

As the legitimate intensities of working stresses, when impact is included in the loading (see "Bridge Engineering," p. 776), are 2000 lb. for the higher-grade woods, such as long-leaf yellow pine, Douglas fir, Pacific-Coast cedar, Western hemlock and white oak, and 1500 lb. for the lower-grade woods, such as the soft pines, spruce, tamarack and redwood, it is evident from the last table that the over-stresses on the joists sometimes run as high as 100%. While such an overtaxing of the timber will not cause failure when it is new, it certainly is liable to do so after decay sets in. It must not be forgotten that the joists in common use for highway bridges are seldom made of as large scantling as those given herein for standard, and that the actual dimensions of all timbers are always quite a little less than the nominal or commercial dimensions; hence it may be concluded that the ordinary timber floors for highway bridges cannot be relied upon to carry safely modern truck loads.

TABLE I. SIZE AND SPACING OF FLOOR JOISTS FOR HIGHWAY BRIDGES

Panel Length, Ft.	For Class A and Class B Loading	For Class C Loading
16	3 x 14 in., 24 in. c. to c.	3 x 12 in., 22 in. c. to c.
18	3 x 14 19	3 x 14 24
20	4 x 14 18	4 x 14 24
22	4 x 16 20	4 x 16 24
24	4 x 16 16	4 x 16 19

TABLE II. BENDING MOMENTS AND STRESSES IN JOISTS

In Inch-Pounds and Pounds per Square Inch

Panel Length, Ft.	Class B Structures Bending Moment	Class B Structures Extreme-Fiber Stress	Class C Structures Bending Moment	Class C Structures Extreme-Fiber Stress
16	329,000	3,350	221,000	3,070
18	372,000	3,800	251,000	2,560
20	416,000	3,180	281,000	2,150
22	461,000	2,700	313,000	1,810
24	506,000	3,000	344,000	2,060
Average		3,200		2,330

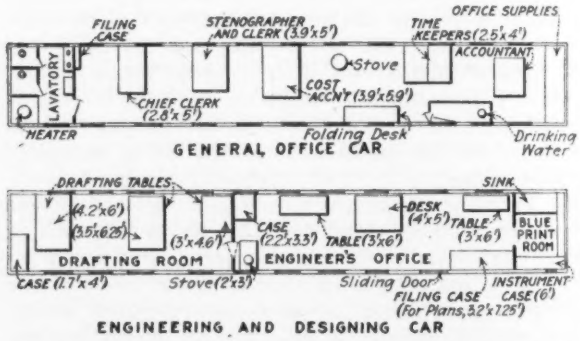
As for the question of danger from fire, there have been of late years so many important highway bridges either totally destroyed or badly injured by the burning of their timber floors that, from the point of view of economics, it does not pay to use such an inflammable material as wood, except where it would be very slow-burning, for instance, in the form of creosoted blocks laid on reinforced concrete. It is a fact that creosoting the planks and joists in a wooden floor adds to their inflammability, but the creosoted blocks in a pavement resting on concrete either would not burn at all or else would be consumed very slowly.

From the preceding does it not seem advisable for all careful and conservative bridge engineers to refuse hereafter to put timber floors in their highway structures?

Rock Island Has Office Cars on Chicago Track Elevation

FOR convenience in the execution of the Chicago track-elevation work on the Chicago, Rock Island & Pacific Ry., the engineering staff is quartered in movable offices consisting of two cars specially fitted up for the purpose. These are placed on sidings convenient to the work, and are moved ahead as the work progresses. There is also a hospital car with medical and surgical equipment, attended by a physician representing the railway and the insurance company which assumes the casualty risks.

The office cars are old wooden mail and baggage cars which had been taken out of service. They are arranged as shown in the accompanying plan. Each has a single side door, with a movable outside platform and steps erected on the ground. The original Baker-heater equipment has been utilized, and during extremely cold weather a stove is added. The general office car is provided with desks for the clerks, accountants and time-keepers, as in a regular office. At one end is a lavatory, with the heater, and at the other end is a compartment for office supplies. This car provides accommodation for 10 to 12 office men.



PLANS OF GENERAL OFFICE AND ENGINEERING CARS

Engineering and designing work is done in the other car, the plans being prepared directly in the field and approved prior to construction by the chief engineer in the usual manner. The engineers' car is fitted with desks, tables and filing cases at one end, and a drafting room with three tables at the other. There is also a blueprint and dark room for photographic and printing work. Space is provided for storing field instruments. This car is used exclusively by the field and office engineering force.

In this way all drafting and accounting are done on the work and information is available immediately instead of it having to be obtained from the main engineering offices. This organization of equipment was planned by Robert H. Ford, engineer of track elevation of the Rock Island.

Getting Chemicals for Treatment of Water in Ohio

State Department of Health Aided Water-Works—Federal Coöperation Obtained

UP TO Apr. 10 water-works in Ohio were still having difficulty in obtaining less than carload lots of chlorine for water treatment. A summary of the recent activities of the Ohio State Department of Health, in behalf of getting for the cities of the state ample and uninterrupted supplies of all classes of chemicals used in water treatment, prepared by W. H. Dittoe, chief engineer of the department, has been sent to *Engineering News-Record* by Dr. A. W. Freeman, commissioner of health. The summary reads as follows:

During January, 1918, it became evident to the Ohio State Department of Health that serious shortages of supplies of chemicals at the various water-purification plants throughout the state would occur unless arrangements were made to prevent abnormal delays in shipments. One of the largest water-filtration plants in Ohio ran out of alum entirely Jan. 9 and was forced to operate without coagulation for nine days. Due to the very favorable condition of the raw water at this time, and to the care of the superintendent in chlorinating the effluent, no outbreak of disease occurred. The situation, however, brought squarely before the department the problem of preventing similar occurrences throughout the state. As the public water-supplies, serving over 2,000,000 persons in Ohio, are purified by processes involving the use of coagulants, softening chemicals and disinfectants, the necessity of maintaining adequate supples at purification plants is evident.

Without delay the matter was brought to the attention of the Surgeon General of the U. S. Public Health Service and the Director General of Railroads. Early in February a ruling was made by the U. S. Railroad Administration, exempting from embargo chemicals to be used in the purification of public water-supplies. Moreover, the office of the Director General of Railroads offered to give special attention to the provision of the necessary equipment and the expeditious handling of loaded cars to destination. This was exactly what was necessary to relieve the situation.

Thereafter the Ohio State Department of Health endeavored to assist the various municipalities and water companies throughout the state in obtaining shipments of chemicals. On Feb. 15 a circular letter was addressed to the superintendent of each plant in the state using chemicals for water treatment and since that time numerous cases have been reported to the State Department of Health and referred to the U. S. Railroad Administration, where prompt attention has been given. Thus shortages have been averted and continuous treatment of public water-supplies has been made possible.

As the ruling of the U. S. Railroad Administration applying to shipments of chemicals did not exempt empty chlorine cylinders, a situation soon arose which threatened to interfere with the regular supply of chlorine. This matter was brought to the attention of the Director General of Railroads, Feb. 21, with the request that empty chlorine cylinders be exempted from the embargo. In circular No. CSl-A, Mar. 26, 1918, empty cylinders were included in the exempted commodities.

The Ohio State Department of Health has encouraged the municipalities and water companies throughout the state to purchase chemicals in carload lots in order to facilitate prompt delivery. This is usually practicable in the purchase of alum, lime, sulphate of iron and soda ash, but with the exception of the largest cities is not practicable in the purchase of chlorine, particularly in view of the shortage of cylinders.

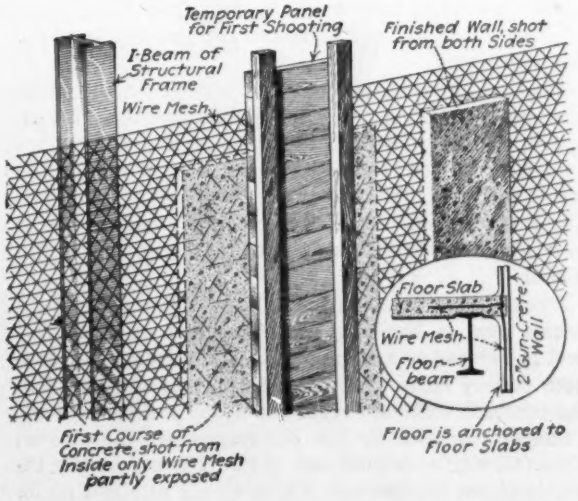
The department has suggested that the manufacturers of liquid chlorine establish in Ohio a central distributing station or warehouse to which the chlorine in cylinders could be shipped in carload lots and from which it could be distributed in smaller shipments, perhaps by express. Thus far this has not been done and trouble is still being experienced in obtaining prompt delivery of freight shipments of chlorine in less than carload lots.

Walls of Concrete Elevator Made Without Forms

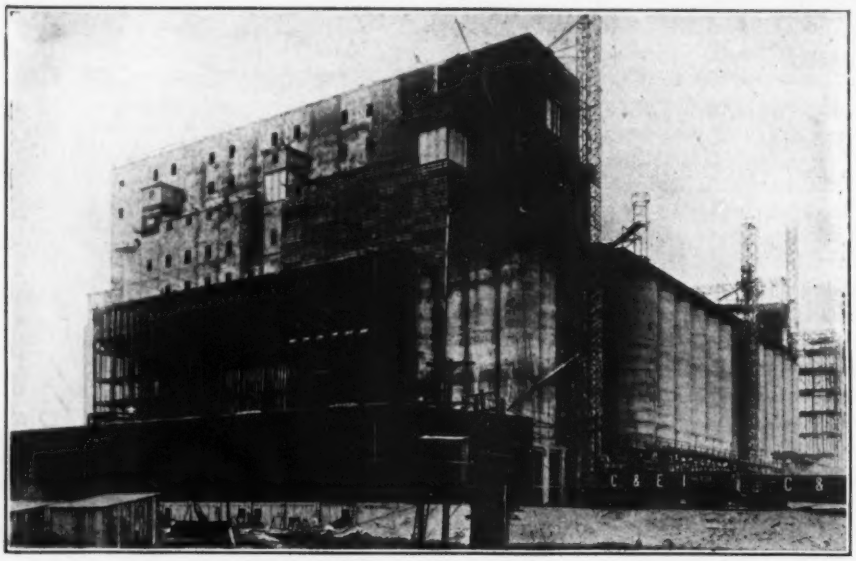
Cement-Gun Process, Applying Concrete to Wire Mesh on Steel Frame, Employed on New South Chicago Plant

WALLS of concrete built by the cement-gun process, without the use of forms, constitute one of the features of the new 10,000,000-bushel grain elevator of the Chicago & North Western Ry. at South Chicago. Ill. This work comprises 180,000 sq.ft. of exterior walls for the track shed, the machinery house alongside of the grain bins, and the five-story working house carried on top of the bins. The working house is 350 x 100 ft. in plan, and its top is 250 ft. above the ground. The bins are of circular section, built of concrete poured in the usual way.

Light structural steel members form the framework of the buildings. Woven-wire mesh is stretched over this and secured by split-ring clips which are sprung


Temporary Panel for First Shooting
Finished Wall, shot from both Sides
I-Beam of Structural Frame
Wire Mesh
Floor Slab
Wire Mesh
Floor beam
2" Gun-Crete Wall
First Course of Concrete, shot from Inside only. Wire Mesh partly exposed
Floor is anchored to Floor Slabs

SHOWING HOW CONCRETE WAS APPLIED TO WALLS



ELEVATOR BUILDINGS HAVE STEEL SKELETON WITH CONCRETE WALLS BUILT BY THE CEMENT-GUN PROCESS

over the flanges of the steel members. Wood panels about 3 x 9 ft. are placed against the outside of the wire mesh, and fastened temporarily to the steel frame. The cement-gun then shoots the concrete or "gun-crete" into place from the inside against the panels till a thickness of about 1¼-in. has been built up. About 24 to 48 hours later the panels are removed, and the exposed surface is cleaned with a blast of compressed air and water. This leaves the surface flush with the wire mesh, which is partly exposed. Upon this surface the final coating of concrete is applied by the cement-gun, making a finished thickness of about 2 in.

No expansion joints are formed. The few cracks which develop are simply surface checks due to shrinkage of the concrete in setting. They do not go through the wall, as those on the inside coating are distinct from those on the outside. The interior surface is troweled to a smooth surface to prevent the collection of dust and dirt. The exterior surface is left rough. Wood forms wired to the metal sash were used for the window openings, to protect the sash from being spattered with concrete and to insure the embedding of the sash in the wall.

Floors in the working house are poured concrete slabs 5-in. and 6-in. thick. The walls are supported at each floor by allowing the slab to extend as a cantilever beyond the steel floor beams to within ½ in. of the outside line of the wall. The wire mesh for the wall, which was placed before the floors were poured, was anchored back into the floor slab, as shown by the accompanying sketch.

Fireproof construction for light buildings is obtained in this way at low cost, as the amount of structural steel is reduced to a minimum, and the amount of concrete is less than with poured concrete construction. The concrete walls and roofs are dense and waterproof.

Concrete applied by the compressed-air cement-gun is a 1:3½ mix of cement and sand. The prepared mixture is blown dry through a hose by air at about 35 lb. pressure, and water is applied by another hose connected to the 1-in. discharge nozzle of the gun. On this work five compressors and five guns were used as a maximum, with seven men to each gang. An air main was laid along the work and tapped at different points for the hose connections. Each gun averaged 1000 sq.ft. per 10-hr. day, this being for the finished wall with its two applications of concrete.

This part of the work on the elevator was commenced in the spring of 1917 and completed in the fall. The Cement-Gun Construction Company was subcontractor under the Witherspoon-Englar Company and Grant Smith & Company, who had the general contract. The structure was designed by the John F. Metcalf Company. All these are Chicago firms. Design and construction were under the supervision of W. H. Finley, chief engineer of the Chicago & North Western Railway.

Government Will Lease Potash Lands

Secretary of the Interior Lane issued regulations under which permits may be obtained to prospect for potash on public lands of the United States. Heretofore, for some years, all lands known to contain potash have been withdrawn from public acquisition. Hereafter known potash lands may be acquired only by lease from the Government. This is the first time the United States has leased its lands, excepting the coal lands of Alaska, which two years ago came under a leasing bill that was passed by Congress. The other mineral lands which Secretary Lane has asked Congress to place on a leasing basis contain coal, oil and phosphate, of which there are now many millions of acres under withdrawal. Bills to permit the leasing of these lands have twice passed the House but have not been passed by the Senate.

Prior to the war virtually the world's supply of potash was developed in Germany, which has immense deposits. Germany is boasting that on the termination of the war the world will again have to obtain its potash supply from her. It is known, however, that large deposits of potash exist in this country, and under the law and under the regulations issued exploitation of these beds will begin immediately.

Permits may be issued to citizens, associations and corporations of the United States for the exploration of not exceeding 2560 acres each of land in compact form, the permits to be for a period of two years. If the permittee discovers potash in commercial quantity and quality he will be entitled to a patent for one-fourth of the area of his permit, the remainder to be subject to lease by the Government. Applications for permits must be filed in local land offices of the United States Government.

New Installation Keeps Ice Away from Keokuk Dam

Pipe Line Across River Supplies Constant Current of Air Upstream of Gates and Prevents Ice Forming

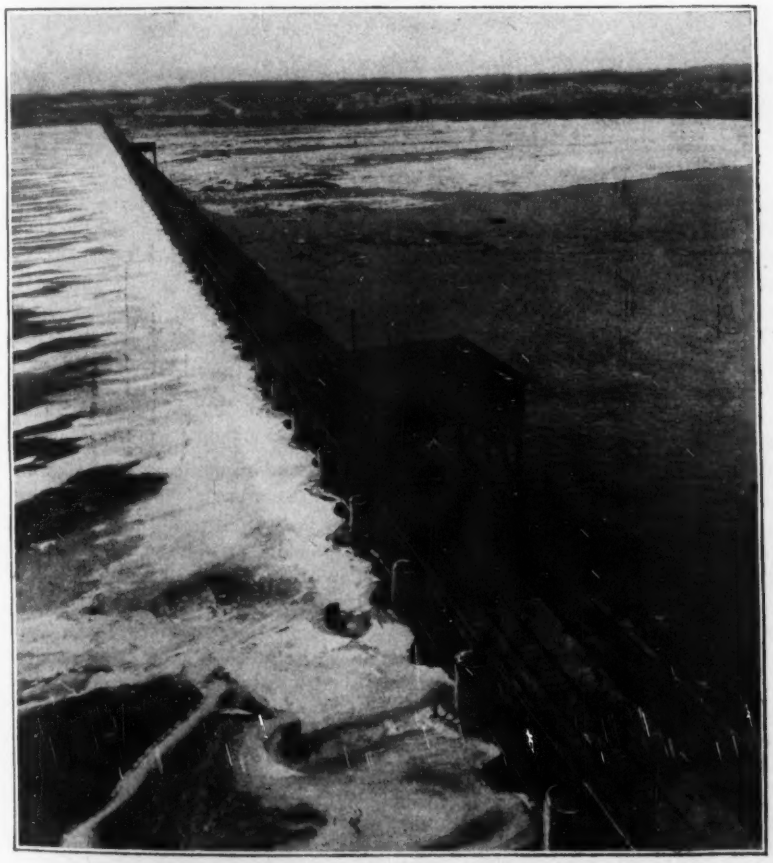
HEAVY ice forming upstream of the Keokuk Dam across the Mississippi River caused serious trouble during the winters of 1915-16 and 1916-17. During the first winter heavy floating ice battered out one of the spillway gates, and in the following winter a steady pressure of thick ice caused permanent deflections in a number of the many gates spanning the spillway openings, which extend clear across the river. To prevent the recurrence of such conditions, early in the winter of 1917-18 a system was devised whereby dry air under pressure was forced out in front of each gate, so agitating the water there as to prevent the formation of ice. This very successful arrangement is described in some detail in the *Stone & Webster Journal*, for March, 1918, by Albion Davis.

Mr. Davis states that in general there are three ways in which ice pressure may be exerted. First, a moving mass of ice may exert pressure by virtue of its inertia. Such an occurrence took place during the winter of 1915-16 at Keokuk. An unusually mild January thaw came while the river was full of heavy ice, which at Keokuk collected in a gorge about four miles above the dam. The pressure of the gorge against the smooth ice cover, about 14-in. thick between the gorge and the dam, finaliy became too great and the whole ice field, 4 sq.mi. in extent, moved steadily about 40 ft. toward the dam. The gates on the dam withstood the impact without injury, but the shore structures near by were in many cases seriously damaged. Severe cold followed this thaw, and froze the mass of ice in the jam solid, thus arresting any further action for the time being. By the latter part of March practically all of the ice in the lake had melted except the heavy part of the jam. This floated aimlessly about the lake until one morning it was driven down the stream by a heavy wind, acting with the current. The nose of this mass of ice, several acres in extent and from 3 to 6 ft. thick, struck one of the gates squarely and carried it out. The two pieces of the 13-ton gate afterward recovered are illustrated in one of the views. It is estimated that to cause such a rupture the ice mass must have exerted a maximum force of 92 tons.

A second type of pressure, the author states, may be exerted by ice when it forms on a confined space, and a third type is the pressure exerted by the expansion of a solid field of ice when its temperature is increased. With regard to this third type Mr. Davis says:

"Contrary to the common idea, ice has a coefficient of expansion just as any other solid. In fact, its coefficient per degree F. is 0.000029, or about four and one-half times that of steel. The range of its temperature is small, however. While the temperature of the upper surface of the ice may be—10° F. at times, the under surface will always be at 32° because of its contact with water. Hence the average temperature of the ice can never be much less than + 11°, and the range of temperature cannot exceed 21°. The expansion in a solid ice field a mile long amounts to 3.2 ft. for this increase of temperature.

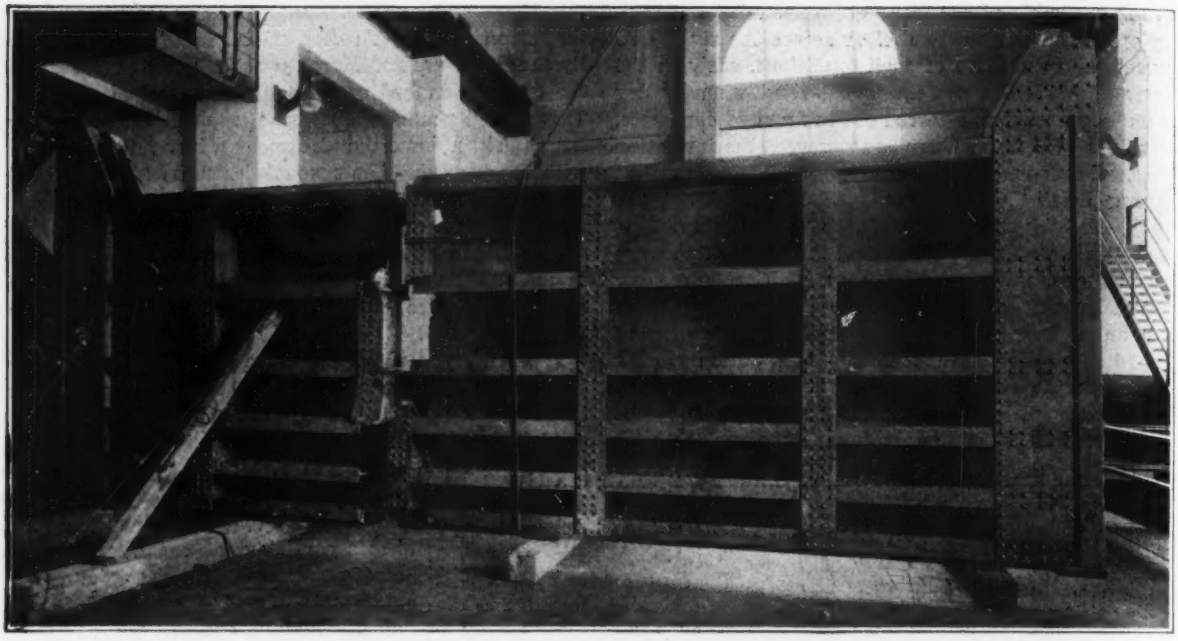
"This type of pressure is not noticeable until the ice becomes solid and from 10 to 12 inches thick. It is first manifested by ice pushed up on the shores of the lake and by ridges of buckled ice running across from shore to shore every mile or so along the river, thus dividing the whole ice cover into fields about a mile square whose centers remained fixed and whose edges are in constant motion while the temperature is changing. An expansion is followed by only a slight contraction when the temperature falls again. Thus there may be



ICE IS BLOWN AWAY FROM EACH ARCH BY SUBSURFACE PIPES

an accumulated expansion amounting to 6 ft., or more. A covering of snow on the ice, which to a certain extent insulates the ice from the upper air, will prevent sudden changes in its temperature and may, if the snow is 12 in. or more deep, entirely eliminate expansion with changes of air temperature."

Such a development of pressure took place at Keokuk in the winter of 1916-17. Heavy ice formed on the lake during a prolonged cold spell to a maximum thickness of about 20 in. A severe cold snap during the first five days of February, with a minimum temperature of 18° below zero, was followed by a short rise of temperature



THIS GATE WAS TORN FROM KEOKUK DAM BY THICK FLOATING ICE HITTING AGAINST IT

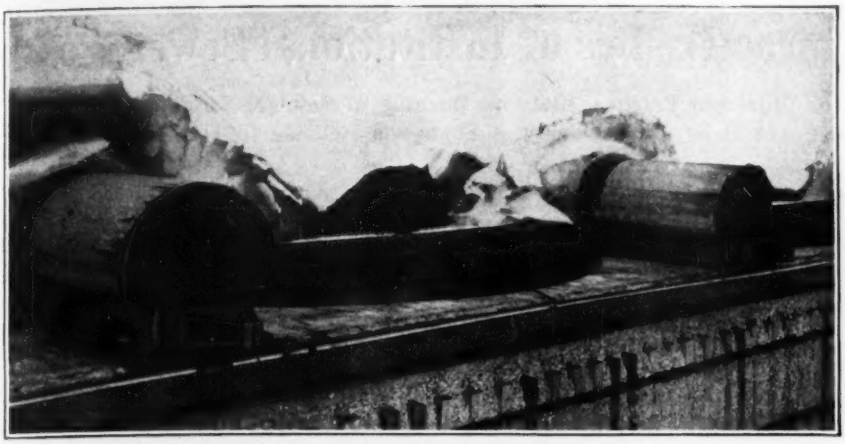
to above freezing. Under this sudden rise the ice in the lake expanded. The rounded noses of the piers tended to break up the ice pressure against them and make the gates take the thrust of the whole ice field. Fluctuations of pond level combined with the enormous energy of the heavy ice field caused localized pressure sufficient to deflect permanently three of the gates, the maximum deflection being about 2½ in. According to Mr. Davis, the uniformly distributed thrust from the ice to produce such a deflection must have been 3.7 tons per linear foot.

When this condition occurred in 1917 remedial measures were taken by thawing slots about 3 in. wide clear across the front of practically every gate on the dam. This thawing was done with steam discharged through a horizontal perforated pipe half the length of the gate. The slots were thawed quickly in front of the individual gates, but to thaw 119 of them took a crew of six men working continuously more than 36 hours. This practically meant thawing a continuous slot over two-thirds of a mile long. Hence this way of relieving ice pressure could be considered as a practical method only in an emergency, but it relieved the serious situation. Immediately thereafter a set of experiments was started to discover the feasibility of using air to keep ice from forming in front of the gates, the idea being to discharge air under water at the middle of each spillway so that the circulation would keep the water open in front of the middle of each gate. The tests are thus described in the paper:

"The tests were made on ice ranging from 10 to 22 in. thick. The work which a very small amount of air could accomplish when discharged under a considerable depth of water was surprising. The explanation of this action is not that the air brings up warm water from below, but that it creates a circulation which keeps water always at a temperature above freezing, passing continuously by the ice edges. A column of water rises with the air and flows radially from the point where the air bubbles break the water surface.

"It was found that a little less than 2 cu.ft. of free air per minute would keep an area 20 ft. in diameter open at an air temperature of 0° F., if discharged vertically upward at 18 ft. depth in a period of about four days. It was also found that for temperatures below freezing the amount of melting was directly proportional to the depth of the air, and that a change of air temperature changed the open water area by roughly 3% per degree Fahrenheit over the ordinary range of freezing temperatures. An orifice calibrated to gage pressures was used to measure flow of air during the tests."

These tests proved so satisfactory that a complete system was designed to carry out the idea as evolved. The system had a sufficient capacity to furnish a maximum of 2 cu.ft. of free air to each gate. The compressor was designed with sufficient capacity to supply the maximum demand on the dam, and in addition to furnish as much air again for use in the power house. This installation was completed and ready for operation a few days after the lake froze over in early December, 1917. Its total cost was well within the estimate of $9500. The installation may be described in the words of the author:



LOOKING DOWN OVER EDGE OF DAM AT CLEARED SPACE IN ICE

"The pipe main is 2 in. in diameter from the power house east for a distance of three-fifths of the length of the dam, and 1½ in. from that point to the last spillway. It was designed by Johnson's formula to carry 2 cu.ft. of free air per minute to each of the 119 spillways with an initial air pressure of 80 lb., and a terminal pressure of 55 lb. Actual losses in operation have checked in general the computed values. Six expansion joints with a total travel of 90 in. are provided for the total length of the main, which is 4270 ft. An anchorage is placed half way between the expansion joints.

"Probably the most important feature of the layout of equipment is the method employed to dry the air supplied to the outdoor system. As known, moisture in air lines out of doors is a fruitful source of trouble during cold weather. With this system especially it would be serious, because any stoppage in the air would allow water to freeze quickly in the discharge pipes where they enter the water. To get the system at work again all of the frozen discharge pipes would have to be removed and thawed individually. To dry the air an after-cooler, capable of removing two-thirds of the moisture-content of the air passing through it, was installed in the pipe line just before it passed out of doors. It cools the entering air by cold water coils and removes the moisture by condensation.

"As a further aid in drying the air, the system was designed to reduce the air pressure from 125 lb. to about 75 lb. gage through a pressure regulating valve. The resultant cooling of the air causes further condensation and drying. To date, however, this regulating valve has not been operated as an agent in drying the air, but has been operated to secure variable pressures in the main on the dam as an aid in adjusting the whole system to climatic changes, it having been found that the after-cooler dried the air sufficiently to prevent freezing in the most severe weather.

"A ⅜-in. needle point valve at each spillway controls the flow of air through the ¾-in. pipes which discharge the air. As the system has finally been laid out these are set so that they discharge vertically upward about 1 ft. in front of each gate and normally at a water depth of 10 ft. This produces a semicircular area of open water in front of the gate. It was found that the air when discharged at 18 ft. depth was too effective for convenient regulation by the small valves.

"The motor-driven air compressor which furnishes the air for the system is a Chicago pneumatic, class O-CB, 17 x 10 x 12, displacing 572 cu. ft. per min. at 181 r.p.m. It has double the capacity that should ever be required for the dam.

"The open water areas have been at all times under the easy control of the small needle valves at the top. These valves seldom need adjustment more than once a week, since a great deal of the regulation can be handled by the pressure regulating valve in the power house. An inspection is made every day or two in the severest weather to make sure that all pipes are working. The expense of labor for maintenance of the entire system for the winter will be less than $150.44.

The installation through the extremely severe weather of 1918 was most successful. The views show the conditions early in this year. There had been a movement of about a foot toward the main field of the dam, and ice had commenced breaking up at the piers. The gate is free from any pressure, as a consequence, on account of the open water area at the center. A bearing is kept against the dam, centering on the pier. Ice formed during January last to a maximum thickness of 25 in. in the open lake, and the results shown in the views have been obtained by the use of about 1 cu.ft. of free air per minute. The maximum capacity of the system has proved sufficient to melt ice from the face of the ice field faster than it can move toward the dam under ordinary expansion. Since the system was thoroughly in operation there has not been a single stoppage in the pipe main or the individual pipes due to freezing, and the system has passed through the most severe conditions that it will ever experience.

Santo Domingo To Build Trunk Highway

Recently the military government of Santo Domingo appropriated $650,000 toward the building of a trunk road to connect Santo Domingo City with Monte Cristi by way of Las Vegas, Moca and Santiago. The proposed work when completed will connect the capital city with the northwest portion of the republic and will give access to the important interior cities, furnishing an artery for the development of domestic commerce and the ready movement of agricultural products. About 18 months will be required for the construction, and bids will probably be invited for the work as a whole or for the different sections separately. At present it is the purpose to advertise both in Santo Domingo and in the United States for bids for the building of the road.

Distinctive Characteristics of Institutional Sewerage

Design Too Often Based on Municipal Practice—Data on Quantity of Sewage, Variation in Flow, Effect of Latter on Sewer Design, and Quality of Sewage in Relation to Treatment

By Henry W. Taylor
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SOME years ago the writer was connected with institutional water-supply and sewerage development and has since retained a sufficient interest in this work, as a field by itself, to collect a few notes as to the peculiar characteristics of institutional sewage. It is thought that in the past due regard has not been given to the differences between institutional and municipal sewage and their effect upon institutional sewerage design. This lack of consideration has resulted in a dearth of reliable data with reference to these matters and too often institutional designs have been based on accepted principles of municipal practice.

Quantity of Sewage—The flow of sewage at various types of institutions has little relation to standard flows, to flows in municipalities, or to one another. The range encountered by the writer runs from 20 to more than 300 gal. per capita per day. The lowest flows occur in case of colleges and camps, and the larger ones at state hospitals.

Gagings of institutional sewage flows have not been extensively recorded, if made. It has been customary to assume that the standard water consumption of about 100 gal. per capita would yield a corresponding flow of sewage. The following data will indicate that this assumption is often wide of the mark. In connection with the water-supply of an institution it must be noted on the one hand that a considerable amount of water is often used in heating plants and power houses and in some instances this water never reaches the sewers, while in others the daily supply to these plants consists merely of a relatively small amount of "make up" water, in cases where the exhaust steam is used for heating purposes or engines are provided with condensers. On the other hand, as compared with general municipal conditions, the institutional community is "all connected" to the sewer system. It may also be assumed that the water used for washing piazzas, sprinkling, etc., is not generally a large factor and would be balanced easily by a small amount of ground water infiltration.

The following table includes records of reliable tests of sewage flow at institutions, together with measurement of the water consumption in cases where these may be taken as an index of sewage flow. The data includes recorded experiments by the state departments of health of Ohio and of New York, together with data from institutions with which the writer is familiar.

TABLE I. SEWAGE FLOWS AT VARIOUS INSTITUTIONS, BASED ON SEWER GAGINGS OR WATER CONSUMPTION

No.	Name	Gal. per Capita, 24 Hours	Method of Measurement
1	Fairmount Children's Home	100	Nos. 1 to 12 inclusive, determined by gaging flow, mainly at siphon tanks, but Nos. 4 and 8 are weir gagings.
2	Infirmary, Dayton	25	
3	State Hospital, Gallipoli	122	
4	Boys' Industrial School	50	
5	State Reformatory, Mansfield	80	
6	State Hospital, Massillon	137	
7	Institute for Feeble Minded, Morgans	53	
8	State Hospital, Toledo	150	
9	Wayne Co. Children's Home	20	
10	Soldiers' Home, Sandusky	151	
11	Infirmary, Trumbull Co	37	
12	Infirmary, Washington Co	31	
13	Reformatory, Bedford	75	Weir in sewer
14	Custodial Asylum, Newark	50	Water estimated
15	Custodial Asylum, Rome	160	Metered water
16	Training School, Hudson	50	Metered water
17	State Prison, Auburn	110	Metered water
18	Agricultural School, Morrisville	25	Water reservoir displ.
19	House of Refuge, Albion	200	Water metered
20	Soldiers' Home, Bath	90	Water estimated
21	Indian School, Iroquois	100	Est. from water pump
22	State Hospital, Willard	216	Est. from water pump
23	State Hospital, Utica	150	Water measured at pumps
24	State Hospital, Binghamton	263	Water measured
25	State Hospital, Brooklyn	152	Water metered
26	State Hospital, Kings Park	173	Water measured at pumps
27	State Hospital, Middletown	104	Water metered
28	State Hospital, Poughkeepsie	310	Water measured at filters
29	State Hospital, Gowanda	200	Water estimated
30	Women's Relief Corps, Oxford	110	Water-tank displ.
31	Hospital, Raybrook	100	Sewer gaging
32	Y. W. C. A. Camp, Altamont	20	Water-tank displ.
33	Colgate University	22	Water metered
34	Bradford County Almshouse Penn	60	Water-tank displ.

TABLE II. AVERAGE TEMPERATURE OF AIR AND SEWAGE AND MONTHLY AVERAGE SEWAGE FLOW, OHIO SOLDIERS' AND SAILORS' HOME, SANDUSKY, OHIO

Month	Temp., Deg. F. Air	Temp., Deg. F. Sewage	Sewage Flow, Gal. per 24 Hr. Average	Maximum	Minimum
July, 1906	75	77	180,000	250,000	160,000
August	77	78	180,000	250,000	160,000
September	67	72	173,000	250,000	160,000
October	53	76	173,000	200,000	160,000
November	40	61	170,000	300,000	160,000
December	33	59	188,000	250,000	160,000
January, 1907	28	53	174,000	350,000	160,000
February	24	52	168,000	200,000	160,000
March	41	62	182,000	350,000	160,000
April	40	64	170,000	200,000	160,000
May	40	65	176,000	250,000	160,000
June	65	72	184,000	300,000	160,000
July	71	74	170,000	350,000	160,000
August	71	76	170,000	250,000	160,000
September	64	73	170,000	250,000	160,000

Flow measured at siphon tank. All hourly variations lost, but there is indicated a daily variation in flow of about 160%, using only the lower and average maximum quantities. Ground-water infiltration may have influenced larger maximum values.

The determinations at the Ohio institutions were generally made by noting the period of fill of a siphon chamber, weir measurements being made in the case of Nos. 4 and 8. In several instances per capita water consumptions were determined by meter measurements of water delivered to the institution, while in many cases the water consumption was determined by pump records of reliable character. In other cases the water consumption has been determined by the tank displacement.

TABLE III. FLOW OF SEWAGE AT DIFFERENT HOURS OF THE DAY, MAY 2-3, 1907, BOYS' INDUSTRIAL SCHOOL

Hour	Gals. in 24 Hr.	Percentage of Average	Hour	Gals. in 24 Hr.	Percentage of Average
6.00 a.m.	126,000	217	6.00 p.m.	43,000	74
7.00 a.m.	61,000	105	7.00 p.m.	50,000	86
8.00 a.m.	91,000	157	8.00 p.m.	43,000	74
9.00 a.m.	80,000	138	9.00 p.m.	61,000	105
10.00 a.m.	138,000	248	10.00 p.m.	43,000	74
11.00 a.m.	70,000	120	11.00 p.m.	43,000	74
12.00 a.m.	61,000	105	12.00 p.m.	43,000	74
1.00 p.m.	50,000	86	1.00 a.m.	43,000	74
2.00 p.m.	50,000	86	2.00 a.m.	43,000	74
3.00 p.m.	43,000	74	3.00 a.m.	43,000	74
4.00 p.m.	61,000	105	4.00 a.m.	43,000	74
5.00 p.m.	70,000	120	5.00 a.m.	43,000	74

Measurement by weir in sewer.

The table shows that per capita daily water consumption at various types of institutions varies from 20 to over 300 gal. A rough classification of the amount of con-

consumption at different types of institutions shows what may be reasonably expected from each:

Institution	Daily Per Capita Sewage Flow, Gal.
Tent camps	20– 40
Colleges	20– 60
Almshouses	50– 80
Custodial asylums	50–150
Prisons	60–125
State hospitals	100–300

Variations in Sewage Flow—The data on variations in sewage flow recorded in Tables 2 to 6 are believed by the author to be reliable. From them the following deductions may be drawn. Minimum flows will in general be about 50% of the average flow. Maximum flows for the maximum hour of maximum days will approximate 250% of the average flow.

Such conditions at once make themselves felt in a sewer system. There is danger in designing a sewer too large as well as too small. The minimum-flow velocities should not be too low and as a rule the maximum discharge should not fill the sewer to more than 2/3 depth.

TABLE IV. TOTAL SEWAGE FLOW FOR DIFFERENT DAYS OF THE WEEK, MARCH 10 TO JUNE 16, 1917, GALLIPOLI STATE HOSPITAL FOR EPILEPTICS

	Thousands of Gallons in 24 Hours						
	Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
Maximum	247	207	209	209	211	248	216
Minimum	130	125	143	114	116	142	123
Average	192	170	167	173	170	188	184

Measurement made by automatic recorder of fill of siphon tank.

Such an assumption leaves 0.2 of the full capacity of the sewer as a reserve. Assuming that the maximum peak flow may reach a 2/3 depth in the sewer, the following will approximately obtain as to quantity, velocity and depth of flow for the maximum and average conditions. If

Q = Full capacity,

V = Velocity when flowing full,

D = Full depth,

the three critical conditions of flow may be expressed as follows:

Minimum Flows	Average Flows	Maximum Flows
$q = 0.165\ Q$	$q = 0.33\ Q$	$q = 0.80\ Q$
$v = 0.7\ V$	$v = 0.9\ V$	$v = 1.11\ V$
$d = 0.27\ D$	$d = 0.4\ D$	$d = 0.67\ D$

A sewer slope and size must be determined on the basis of the above relations and in the case of minimum flows, 0.7 V must not be too small, and 0.7 of the velocity of the sewer when running full is the important factor in design rather than the full flowing velocity. Furthermore, the minimum depth of 0.27 of the full depth of the sewer must also be taken into account, and, on the other hand, maximum flows will not exceed a 2/3 depth of the sewer and ample capacity will be provided for maximum conditions. The wide range of flow applies with especial point to the design of inverted siphons.

The above variations in flow must necessarily be considered as factors in disposal design, especially for the mechanical equipment. A dosing siphon designed on the basis of municipal practice would often prove entirely inadequate. A tankage design on the basis of a 2½- or 3-hr. detention for the average flow would furthermore give such a scant period of detention for maximum flows as to seriously interfere with the operation of the plant. It must also be remembered that the maximum flows include elements in the sewage which are most difficult to handle in disposal, such as abnormal quantities of soaps, fats and greases, together with a certain amount of disinfectants and chemicals. Tankage must be designed to equalize these variations. A variable-level tank, with floating overflow or orifice control, is in many cases worthy of consideration. At any rate, the period of detention must be considerably increased. This can be done without ill effects, due to the relative freshness of the sewage when it reaches the disposal plant. The design of siphons for automatic

TABLE V. WEIR GAGING OF SEWER FLOW AT STATE REFORMATORY, BEDFORD HILLS, N. Y.

(From Report of New York State Department of Health)

Time	Rate of Flow Gal. per 24 Hr.	Per Cent. of Average
3.00 p.m.	72,500	171
4.30 p.m.	50,500	119
6.00 p.m.	50,500	119
9.00 p.m.	31,500	74
10.30 p.m.	31,500	74
12.00 m.	19,500	46
2.00 a.m.	19,500	46
4.00 a.m.	19,500	46
6.00 a.m.	19,500	46
7.30 a.m.	66,000	155
9.00 a.m.	72,000	171
10.30 a.m.	56,000	132
12.45 p.m.	51,000	120
2.30 p.m.	66,000	155
Average taken	42,400	

Ratio of minimum to maximum 3.7 to 1

Gaging of flow for one 24-hr. day. Table does not include the added variation due to daily flow variations.

dosing of filter beds is primarily affected by these flow conditions. The siphon chamber must be either protected by hydraulic regulation of some sort or else the siphons must be large enough to be capable of a clean break, at minimum heads of the siphon, with maximum sewage flows.

In the majority of cases, in determining rates of filtration, allowance must be made for the fact that the day rate of treatment will be relatively large as compared with the night rate. This will probably be true, in spite of such equalization of flow as it is practicable to effect in the primary process of treatment.

Quality of Institutional Sewage—Available chemical analyses of institutional sewage have covered such a short period of time as to be of little interest. These analyses also fail to record many known characteristics in institutional sewage which radically affect disposal design. They indicate a certain amount of variation in chemical characteristics at different hours of the day, but a study of these analyses does not give due weight to features of the sewage which are distinctive and which have been the cause of a considerable amount of

TABLE VI. MAXIMUM AND MINIMUM HOURLY FLOWS AT SOME OF THE INSTITUTIONS QUOTED IN TABLE I.

No.	Gallons per 24 Hours			Ratios to Average	
	Minimum	Average	Maximum	Minimum	Maximum
1	7,000	15,000	23,000	48	153
2	4,200	8,000	20,000	49	250
3	80,000	177,000	350,000	45	198
4	43,000	58,000	138,000	74	242
8	191,000	300,000	760,000	64	252
10	80,000	170,000	400,000	47	236

Tabulated from Report of the State Department of Health of Ohio, 1908. Represent gagings and estimates of maximum and minimum flows as result of several inspections, etc.

trouble and many partial failures in plant operation. The writer believes that a more positive indication of some of the abnormal elements in institutional sewage would result from obtaining information as to the amounts of certain materials which reach the sewers. Letters were written to about one hundred institutions asking for information as to the soaps and soapy matters, acids, ammonias, bleaches, limes, etc., which were

used at the institutions during 1916. The data received in response from 17 institutions throughout the country are given in Table 7. It will be noted that the total soaps discharged into the sewers per capita per year varies at different institutions from about 4 to 40 lb.

On tabulating the figures for soaps, including quantities listed under "cleanser," it was seen that when the low totals for soap occurred the figures for "washing soda" were high, so a second summation was made to include these washing soda quantities, with a resulting increase in the per capita consumption of soapy matters. These second per capita figures are probably more representative than the first, and it is thought that the washing sodas will have an effect upon a disposal process similar to a soapy and greasy element in the sewage.

As compared with the per capita figures given, it may be stated as an approximation that the normal per capita consumption of soaps for a domestic sewage would approximate 10 or 12 lb. per year. If one pound of soap will soften 167 gal. of water of a hardness of 20, and we estimate that 2% of a per capita water consumption of 100 gal. per day were thus softened, the total per capita soap consumption per year would be about 4.5 lb. Allowing for waste and a hardness of, say, 60 parts, this estimate might be doubled, giving a figure of 9 lb. per year. From such direct information as is at hand, it would appear that about 10 lb. of soap per capita would be a fair figure for the ordinary household in which the laundry work is done in the house.

The hardness of the water at the institutions listed is not given in all cases, but is noted for Nos. 1 to 5. Although extreme hardness of water would increase the consumption of soap it is apparent in the first five cases that this factor alone would not account for the high rates tabulated.

In addition to these soapy matters, there are known to be large quantities of greases and fats from kitchens. The determination of the latter would be hardly practicable, but the fact that institutions are operated as one large family with all cooking and scullery work undertaken at the same time, produces a concentration of flow of these additional fatty matters which intensifies their influence on disposal works. In some institutions grease trap manholes outside of a group kitchen have intercepted large quantities of fats, amounting to over 1000 lb. per year.

It is unnecessary to comment upon the effects of excess quantities of the soaps, greases and fatty matters in connection with any primary or secondary process of sewage treatment. The major difficulties in institutional sewage treatment have arisen from the presence of these elements and various expedients must be resorted to in order to counteract their effects on the chemical and biological action of a sewage-works.

Little attention has been given to the fact that in institutions, especially state institutions, large quantities of bleaches, lime, ammonia and acids are used in the process of bleaching and disinfecting clothing, etc. It must also be remembered that these latter elements are discharged into the sewers, not on a uniform basis, but on probably not more than two or three days of the week and during a relatively small part of these few days. In the table, quantities of these elements have been approximately reduced to parts per million per year of acids, limes, bleaches, etc., on the basis of a normal water consumption of 100 gal. per capita. It will be noted that these quantities run from over one part to almost four parts per million. Taking into account the period of discharge, it is probable that the effect on the disposal plant would be that of several times the tabulated number of parts per million, even when it is considered that many of these chemicals may be largely spent by the time they reach the sewers. In many actual cases studied it would seem to be certain that the discharge of these elements into a disposal plant has had a serious biological effect in both primary and secondary processes of treatment. This is a factor which must often be taken into account and must be overcome by such expedients as are practicable in any particular case.

Temperatures of Sewage—Relatively large quantities of hot water are discharged into institutional drain-

TABLE VII. THOUSANDS OF POUNDS OF LAUNDRY SUPPLIES AND SOAPS USED AT VARIOUS INSTITUTIONS IN 1916

Description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Acids	.....	.....	0.2	.....	0.2	.....	.....	.....	.....	.....	0.1	0.8	.....	0.4	.....	0.2	.....
Ammonia	.....	.....	0.7	0.2	0.4	.....	.....	0.1	.....	.....	.....	.....	0.5	1.6	.....	0.4	.....
Bleach	.....	.....	0.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Blue Vitriol	.....	.....	.....	0.5	.....	.....	0.8	.....	.....	.....	.....	.....	0.2	.....	.....	.....	.....
*Bluing	.....	10.0	13.0	4.0	3.0	.....	.....	7.0	5.0	1.0	11.0	5.0	6.5	1.0	276.0	6.0	.....
*Borax	.....	.....	.....	105.0	.....	.....	62.0	.....	.....	18.0	.....	.....	10.0	.....	504.0	150.0	350.0
Cleanser	.....	.....	0.3	.....	.....	.....	.....	2.1	.....	.....	3.9	.....	0.5	28.0	.....	10.0	0.7
Detergent	.....	.....	0.2	.....	.....	.....	.....	1.2	.....	.....	.....	.....	0.2	.....	.....	.....	.....
Lime	.....	.....	.....	0.2	.....	.....	.....	0.4	.....	.....	.....	.....	.....	.....	.....	.....	.....
Lime, Chloride of	.....	.....	0.1	0.4	1.2	0.01	0.07	0.03	.....	0.04	0.2	.....	0.4	0.5	.....	.....	0.2
Soaps:																	
Chip	.....	1.5	7.8	22.4	38.2	0.2	0.1	5.0	16.3	10.0	5.2	21.9	6.2	.....	2.3	8.0	3.5
Kitchen	.....	.....	.....	.....	9.5	1.7	0.1	8.2	.....	3.2	4.0	17.4	.....	.....	3.5	2.6	1.1
Laundry	6.0	12.9	2.3	6.2	0.5	.....	8.5	1.7	7.5	6.0	11.7	3.9	26.6	9.7	10.0	4.8	5.2
Powder	.....	.....	.....	4.0	.....	0.3	0.3	3.2	.....	2.8	5.7	14.9	.....	0.8	.....	4.5	4.5
Scouring	.....	.....	.....	.....	1.8	0.6	1.3	1.0	3.0	0.5	1.2	10.1	.....	1.0	1.5	2.1	.....
Shaving	0.05	.....	.....	0.04	.....	.....	0.2	0.2	0.1	0.07	0.04	0.02	0.06	0.1	.....	0.05	.....
Toilet	2.1	2.0	1.7	4.7	4.4	1.7	15.9	6.0	5.6	9.8	1.3	5.3	1.2	10.4	2.5	2.5	0.2
Sodas:																	
Caustic	3.6	.....	1.8	.....	2.7	.....	.....	.....	.....	.....	.....	.....	0.6	5.8	.....	.....	.....
Sal	7.0	2.4	.....	1.0	6.6	.....	.....	0.6	.....	1.4	.....	4.9	.....	2.4	2.6	.....	0.7
Washing	11.2	2.2	1.7	11.2	18.7	0.3	0.06	10.3	42.8	14.0	.....	37.8	31.4	.....	5.5	.....	3.4
Total Soaps	8.2	16.4	11.8	37.4	54.4	4.4	26.3	27.4	32.5	32.6	33.2	73.6	34.5	49.9	19.9	34.6	15.2
Total Sodas	21.8	4.7	3.5	12.2	28.1	0.3	0.07	10.9	42.8	15.4	.....	42.7	32.0	8.2	8.1	.....	4.1
Total Acids, etc	.....	.....	1.5	0.8	1.8	.....	.....	1.8	.....	.....	.....	0.8	0.6	2.0	1.1	0.6	.....
Total Soaps and Washing Sodas	19.3	18.6	13.5	48.5	73.1	4.7	26.4	37.7	75.3	46.5	33.2	111.4	65.9	49.9	25.4	34.6	18.7
Population (1 = 1,000)	2.2	0.5	0.3	1.2	1.5	0.2	1.8	1.7	1.6	1.2	1.2	2.0	1.8	1.8	0.5	1.2	1.3
Soaps per capita	3.72	32.8	39.4	30.0	35.2	23.6	14.9	16.1	20.6	26.2	26.5	35.9	18.9	27.5	39.7	29.2	11.4
Soaps and Washing Sodas per capita	8.8	37.2	45.0	40.4	48.7	25.0	15.0	22.4	47.7	37.5	26.5	54.3	36.0	27.5	51.5	29.2	13.9
Sodas per capita	10.0	9.4	11.6	9.8	18.2	1.6	0.04	6.4	27.1	12.5	.....	20.4	17.5	4.5	16.1	.....	3.1
Parts per million, acids, etc.	.....	.....	16.4	2.3	3.8	.....	.....	.....	.....	.....	.....	1.2	1.1	3.6	.....	1.7	.....
Hardness of water, p.p.m.	180.0	65.0	40.0	20.0	100.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

* Bluing and borax given in pounds rather than thousands of pounds.

age systems. The central heating and power plants, the laundries, group kitchens, dish-washing machines, bath and shower rooms, constant scalding of utensils, mopping of floors and corridors, contribute to this large volume. Comparison with ranges of temperatures at municipal plants indicates a very considerable excess of temperature and a more or less striking continuity of high temperatures in the case of the institution irrespective of the time of day or month of the year. These temperatures may assist biological processes of sewage disposal during the winter, but they hold greases and fats in emulsions or colloidal state and retard a much desired coagulation, settlement or flotation of these elements in the sewage. Reasonable attempts must be made in the design of both the sewers and the disposal plant to overcome excessive temperatures by special treatment of concentrated wastes which chiefly contribute these temperatures.

Motor Vehicles Operating as Common Carriers Are Licensed in Maryland

Amount of Fee Based on Intended Use of Highways—Service Must Be Maintained and Extended As Required To Meet Demands—Author of Law Is Highway Engineer of State

By Mont Schuyler,
Associate Editor, "Engineering News-Record"

NO GREATER nor more pressing problem will confront the highway engineer in the years to come than that concerned with the regulation of the use or misuse made of the roads by heavy motor vehicles. In fact it may be said that if a satisfactory solution can be found, the matter of distributing maintenance and such construction charges as rightfully should fall on the user, will be much simplified. Laws now in force in Maryland deal with the collection by the state of funds proportionate to the use made of the roads by the most modern of common carriers—the motor bus and truck.

Like all new legislation, the Maryland law was forced by the accumulation of abuses which always arise when a new opportunity is seen first by a few and then abused by the inevitable and indiscriminate multitude. In this particular instance, the sudden popularity of the "jitney bus" furnished the occasion. No provision had been made in the statutes for such an innovation, and the new convenience became first an amusement for newspaper humorists, then an opportunity for occasional profit to the owners of cheap and second-hand automobiles, and finally wound up by developing into a mad scramble for small change between the irresponsible owners of the conveyances. The chaos of annoyance to the public, whose convenience was sidetracked, yielded primacy only to the reign of terror which was the inevitable consequence of the speeding indulged in by chauffeurs in order that more trips might be made. In addition, the crowding of the main thoroughfares of Baltimore made the normal commercial life of the city almost an impossibility.

Engineer Writes Regulative Measures

At the request of the Public Service Commission, H. G. Shirley, highway engineer of the State Roads Commission, drew up two bills intended to curb the nuisance and secure for the state a fair return for such uses of the roads. Of these bills, one was intended to regulate the "jitney bus" and the other, common-carrier freight traffic. In the Legislature at the same session was a convention licensing bill, intended to cover in blanket fashion the ordinary taxation of vehicles. The common carrier's tax was to be in addition to the licensing provided for in this last bill.

As soon as the first two bills were introduced the unorganized operators of motor buses and trucks doing a common carrier business formed an association to fight the legislation. They felt their assumed privilege to have been attacked, and without consideration of their rights. In any case their protests made up in violence what they lacked in logic, and it seemed for a while that the legislation would be killed. At this point the Governor of the state turned the situation over to the engineer-author of the bill, who counter-attacked with a display of engineering data that had been previously secured over a period of several months. In view of the character of the reasons lying behind the proposed regulation, the Legislature passed the laws which took effect July 1, 1916.

Fees Based on Use of Roads

In brief, the points covered by the two bills are as follows: Section 1 of the "Passenger Motor Bus Law" reads in part as follows: "It shall be the duty of each owner of a motor vehicle to be used in the public transportation of passengers . . . over state, improved county roads and streets and roads of incorporated towns and cities . . . to secure a permit from the Public Service Commission of Maryland to operate over said roads and streets, and present same to the Motor Vehicle Commissioner annually." An application in writing for registration must be filed with the commissioner of motor vehicles, which must state "the seating capacity for passengers of said vehicle, the route on which said motor vehicle is to be used, whether reserve or substitute cars are maintained by the applicant to be used only in emergencies, and if so, the number of such reserve and substitute cars and a complete dscription of each . . . the length of route in miles on state, state aid, improved county roads, and streets and road of incorporated towns and cities, respectively, in the State of Maryland, the weight of the vehicle, the schedule under which it shall operate during the ensuing year, and for all such motor vehicles, its substitute or reserve vehicles, the following annual fee shall be paid to the commissioner of motor vehicles for certificates of registration issued by him, and no other additional fees, license, or tax shall be charged by the state or any muni-

cipal subdivision thereof except the regular property tax in respect to such vehicles or their operation."

The next portion of this section relates to the fees which are to be charged for different weights and carrying capacities of such motor buses. It provides that a bus weighing less than 3000 lb. shall pay one-twentieth of a cent per seat per mile of route indicated by the application. The other classifications provide a charge of one-eighteenth of a cent for vehicles between 3000 and 7000 lb., and one-fourteenth of a cent for vehicles weighing over 7000 lb. per seat per mile of route. There is nothing in the law which prevents the owner of a licensed motor bus from making more than one trip per day—in fact, he can make as many trips as he desires, provided that he keeps on the route which has been assigned to him. The granting of a permit or franchise is left in the hands of the Public Service Commission, which must determine whether or not it is in any way prejudicial to the welfare and convenience of the public. Furthermore, this same commission is empowered to make such rules and regulations as it may find necessary to govern the operation of motor buses, providing also the right to assess penalties or even forfeit the permit if violations of the permit are noted.

The fund returned from such licensing fees is divided among the state roads commission, the board of county commissioners, and the cities and towns of the state in proportion to the mileage falling within each of these several jurisdictions.

The regulations concerning freight trucks are similar in every respect except that this classification is strictly on the basis of capacity, being graduated as follows: Motor vehicles weighing less than three tons when loaded to capacity are charged one-twelfth of a cent per ton-mile of route covered in the application. Trucks falling between three and six tons when loaded to capacity are charged one-tenth of a cent per ton-mile and those over six tons, one-eighth of a cent per ton-mile.

Laws Supplemented by Commission

Of course the laws are not in themselves complete and are supplemented from time to time by rules and regulations issued by the Public Service Commission. In many cases, as might be expected, these supplementary laws are such as might be anticipated, but some of them indicate a desire to maintain the serviceability of the traffic by forbidding, except under exceptional instances, the operation of a licensed truck over any other route than that shown in the permit. Furthermore, legible signs must be displayed on either side and in front which will indicate the termini of the route or else the name of the street, road or public highway which forms the greater part of the route. Furthermore, fixed time schedules must be maintained by the licensees in all except emergency cases. The commission likewise reserves to itself the right to regulate the fare or rate which the applicant for a license will be permitted to collect.

With respect to the passenger buses in particular, definite rules have been drawn up by which the seating capacity of a vehicle is to be determined, and it is unlawful for any operator of a bus to carry a greater number of passengers under any circumstances than the number indicated by his license. Likewise, interruptions to the service must be reported to the commissioners, if it seems probable that such interruptions will continue for a period more than twenty-four hours, and in all cases sufficient reserve equipment must be maintained to insure a reasonable continuance of established routes and fixed schedules.

From certain points of view these two laws are a tax on business and to that extent not fully in accord with the indefeasible concept that a tax on activity is not the most enlightened method of raising revenue. But in spite of this criticism these enactments effect a distribution of a definite expense which the state at large would otherwise have to bear, and in connection with the regulation which is placed in the hands of the Public Service Commission, the citizens of the commonwealth are enabled definitely to extend their commerce with full assurance that plans, of necessity made ahead of time, will not miscarry because it may not prove convenient for the authorized carrier to undertake the work when the service is needed.

Compromises with Conditions

There is nothing in either piece of legislation which places a ton-mile tax upon a merchant or corporation which owns or operates, in its own service, either trucks or buses. Apparently this introduces an inequality, inasmuch as the law, to that degree, subsidizes the larger enterprises. But it should be recognized that the Maryland legislation frankly makes a compromise with conditions, inasmuch as it recognizes the necessity of granting certain privileges under regulation and at a price. There is the further realization that the larger industries undoubtedly pay an equivalent tax in the form of corporation taxes, and that their stability insures a respect for the laws which would be hard to obtain from the owner of only one truck, and that truck perhaps the only property held by him.

The granting of a permit to operate a truck over a certain route as a common carrier is actually a franchise. The trucking business in territory served becomes the exclusive property of the holder of the permit, just as the holder of a franchise for a street railway owns the right to operate street cars over the streets of the commonwealth which has granted it the franchise. There is this very excellent proviso, however: If at any time there arises a demand for service which the truck owner cannot satisfy, and complaints are made that his service is insufficient, he must appear before the commission and show cause why a parallel franchise should not be granted to someone else. Thus he has the opportunity to better his service by putting on more or larger trucks, or making more frequent trips. In any case, his right to operate over the route is not abrogated, but he is denied the exclusive privilege when he proves unable to meet the demands of his present or possible customers. It definitely guarantees the continuance of the privilege, to exercise which he has made an investment, but in no way prevents the normal or even unexpected growth of the community he is serving.

No doubt there are many who are not yet completely satisfied by either the intensity or the character of the service, but on the whole the species of regulation enforced by this regulation has proved an excellent method of bringing the rural districts closer to the metropolitan centers of the state.

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

Why Minnesota Leads in Organization

Recently an Eastern engineer interested in engineering organizations journeyed to Minnesota to learn the source of society energy among engineers in that state and to bring away some inspiration. Minnesota is one of the sections of the country where democracy prevails in the engineering profession and where much is done in an organization way when the relatively small number of engineers is considered. The visitor to Minnesota found that many of the profession who have come to occupy high positions keep up their society activity. They meet and work on the same plane with their fellow engineers of whatever position. Such men as Ralph Budd, executive vice president of the Great Northern, and F. E. House, president of the Duluth & Iron Range, are democratic. "If the leaders are democratic we have a democracy and that's about all there is to it," said this inquirer after society service.

To promote good fellowship the president of one local society started the custom of addressing members of the board by their first names. Now it's Ed and John and Jim. It soon grew into an easy habit and is being taken up by committeemen and may spread through the society.

Classifying the Membership

The Seattle Engineers' Club, on an occasion when many out-of-town visitors were expected who might want information that engineers could supply, prepared a classified list of members in leaflet form, with which was printed an invitation to call on those listed under each heading for information pertaining to their specialties. Some of the headings, of which there were 26, were: Building construction, factory sites and state lands, labor conditions, mining, iron and steel supplies and equipment, machinery and industrial plants. In this way it was made convenient for visitors to have their questions answered authoritatively at the same time that club members were given opportunity to meet those interested in their lines of development.

Why Not Unite in an "Engineers' Building"?

A committee appointed by the Seattle Engineers' Club is studying the possibility of establishing a headquarters for engineers in what would be known as the "Engineers' Building," where there would be opportunity for the maximum of coöperation between organizations and individuals and the advantage of "quantity buying." It is proposed that quarters for the Engineers' Club be provided in the building as a nucleus and that this be made the common ground for getting together. Some of the features would be an engineering reference library, a blueprinting establishment, and a tenant who sold a general line of engineering supplies and would test and standardize instruments. It is pointed out that such a building would not only become known as the logical place to find engineers but would facilitate the exchange of professional courtesies between offices. Because of high construction costs at present, the possibility of finding a suitable structure that could be leased is the plan to which the committee is giving preference.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Was Poor Pipe the Cause of Failure?

Sir—In reading the article "Outfall Sewer of Poor Concrete Pipe Disintegrates," in *Engineering News-Record*, March 14, p. 525, it occurred to the writer that some observations made by him and R. J. Wig, then of the Bureau of Standards, might be of interest.

In the early part of November, 1915, we stopped in Calexico en route to Yuma, Ariz., where we had installed one of our experimental concrete drain tile lines, by means of which we hoped to determine the effect of alkali on concrete drain pipe. While in Calexico we noticed a considerable number of concrete sewer pipes being made and were struck with the lack of care used in their manufacture. The climate in this locality is very dry and the sun hot.

As far as we could observe, no effort whatever was being made to keep the freshly manufactured pipe moist, and of course the cement never had a chance to develop its strength. All the pipes we saw were chalky and the walls soft, and we remarked that such pipe should be condemned and that if it ever was used failure undoubtedly would result.

In reading Mr. Sherman's article it occurred to us that very likely the pipe we observed at Calexico was what he referred to. LEWIS E. FERGUSON.

Washington, D. C.

How Can Efficient "Engineering Co-operation" Be Secured?

Sir—In your issue of Mar. 28 I note a communication from Charles Whiting Baker, in which he takes issue with certain propositions advanced by C. E. Drayer. I shall pass that by as a matter of academic discussion and take up another section of the published letter, which treats of the action of the Engineering Council in the hearing before the Railway Wage Commission. He says:

"Imagine one of those organizations asked to deal with such questions as are now coming before the Engineering Council, like the one recently acted on where an appeal was made by an engineer that the council should endeavor to secure from the Federal railway administration an increase of pay for the professional engineers engaged in railway service. The matter was referred to the committee on public affairs, and by that committee, the executive committee and the council's

secretary arrangements were made to have the case effectively presented on behalf of the railway engineers before the Railway Wage Commission at its recent sessions in Washington."

The question now arises, why was not the Engineering Council ready to take the initiative in such a vital question as is this wage question? Why did not the council lead instead of following in the wake of the American Association of Engineers? We were on the job as soon as the wage commission was ready to listen to us, and we did not wait to have an engineer appeal to us; the need was apparent, and in the language of a one-time governor of Wisconsin, we "seen our duty and we done it." (See the issue of your journal of Feb. 14.)

I do not know when the Engineering Council got into action, but the first public notice of it appeared in *Engineering News-Record* Mar. 7 (see p. 465). Now, we are not working for glory, and neither is the Engineering Council; each has as its object help and uplift for the members of our profession, and if we can coöperate as we should, the help and uplift will be hastened; and each should recognize the good work done by the other. If there is rivalry, it should be of the generous kind.

ISHAM RANDOLPH.

Wants Manufacturers to Adopt Uniform Catalog Size

Sir—The General Engineer Depot, U. S. A., is making purchases of material and supplies amounting to many millions of dollars and covering almost every article manufactured. The first requisite of the buyer is catalogs, and after looking over a heterogeneous conglomeration of pamphlets, books, papers and "junk," I am impressed with the idea that some enterprising advertising agent has an opportunity to obtain uniformity in the size, and increase the usefulness of the various catalogs.

What line of reasoning is used whereby one catalog is 11 x 9 in., others 9 x 7 in., 6 x 8 in., 4 x 4 in., 11 x 14 in., and so on, no two alike; when standing on a shelf they look like a row of buildings on Broadway.

The manufacturer sends the order to his printer to get up "something fine." The printer figures how he can cut his paper—and lets it go at that. Would it not be more business-like, the most sensible way, to consider the customer first, his wants, his ability and convenience to handle the catalog? The most important question of all is, How can I place my line of goods before the public in such a way that my catalog is ever in the mind and within the easy reach of the purchaser, and is not consigned to his waste basket?

The answer is conditioned on the reply to this question, "Where will the catalog be kept?" I can tell just what will become of some of the 200 I have now. Those I can stand in a sectional bookcase will remain there, the balance, the large majority, will gradually find their way to the waste basket.

Therefore the manufacturer, if he takes time to think, will find that the sectional bookcase is fast becoming the third item in the list of office furniture, and his catalog, if of proper size, will find a good home therein. A good file of catalogs is an asset to an engineer or contractor.

A uniform size, 10 x 7½ in., with the name on the back, will generally be filed and kept, the renewals being eliminated. Therefore, I suggest that the sectional bookcase govern the size.

The paper should be thin, to save space on the shelf and postage to the sender. EDGAR A. ROSSITER,

Major, Engineer, United States Reserves.

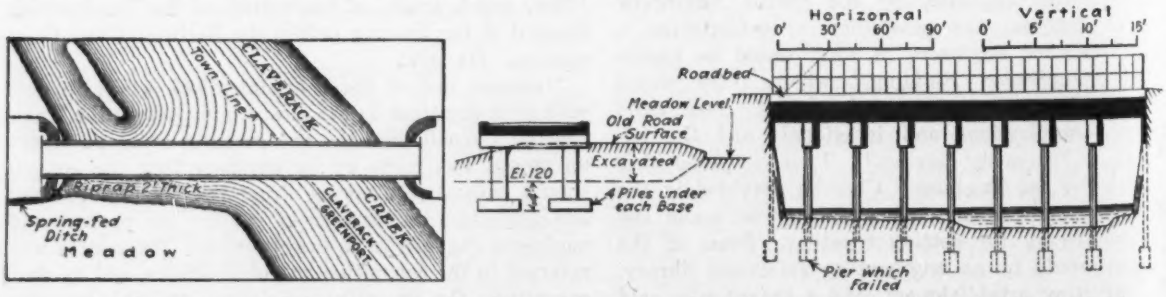
Chicago.

Claverack Bridge Failure Charged to Poor Foundation and Scour

Sir—The collapse of two spans of the Claverack Creek bridge, east of Hudson, N. Y., described by E. J. Doyle in *Engineering News-Record* of Mar. 28, p. 619, was a foundation failure brought about by scour, according to the facts as observed by the writer. No influence of sliding or subsidence of ground as assumed by Mr. Doyle could be detected.

For clearer presentation of the facts a sketch map, profile and section of the bridge are given herewith. The structure is 218 ft. long, comprising eight spans 27 ft. 3¾ in long c. to c.; it was built in 1910. The spans are slabs 22 in. thick, reinforced with 1-in. square bars 6 in. on centers and similar bars over the piers spaced 10 in. on centers. The slabs rest on cross-beams 24 in. wide by 42 in. deep, supported by reinforced posts 2 ft. square. Each post rests on a reinforced base 6 ft. square by 2 ft. thick, supported by four piles 15 ft. long.

Before construction of the bridge the end where the trouble occurred was a solid fill. As the new bridge was to be longer than the old one, the fill was removed for a depth of about 12 ft., the final level being above water level. After this the contractor excavated holes 4 ft. deep for the post bases and over the piles. Subsequent to the erection of the bridge a dam was built about 300 ft. downstream, and this backed the water up so that all of the river bed under the bridge was covered.



FOUNDATION CONDITIONS HELD RESPONSIBLE FOR CLAVERACK CREEK BRIDGE PIER FAILURE

The foundation piles went through a layer of creek gravel and then struck clay so soft that the weight of the hammer alone was sufficient to send the pile to the required depth. This makes it highly probable that the piles did little if any good and that the entire load was being supported on the layer of creek gravel.

The general ground level under the end of the bridge before the failure occurred was about 5 ft. below the level of the meadow adjoining upstream. A spring-fed ditch runs down along the upstream side of the approach, and an island formed just below that end of the bridge, which caused flood water to swirl back under the structure and immediately against the pier which failed. At the time of the failure, ice had jammed some distance upstream and this jam turned much water over the meadow. The action of the water falling from the meadow level combined with the flow of the ditch and the action of the backflow caused by the island had scoured away the creek gravel at this point.

On the afternoon preceding the failure it was noticed that the slab over the pier which went down was sagging. Further, it was reported that last season when the water was low the effect of scour around this pier was noticed, but nothing was done by the authorities to remedy the trouble.

Before the broken slab was cut loose, soundings were made and these showed that the hole was much deeper than the elevation of the base of the posts. Further, the bottom of the hole was in the soft clay, which offered little resistance to the thrust of the pole. It was found impossible to sound back around the posts, and their position is not known. Care was taken to make sure that the adjacent pier bases were not undermined and it was found that the gravel bed came well over their tops.

The broken slab has been cut loose and allowed to go down, the hole has been filled, the necessary approach fill made and traffic restored over the bridge.

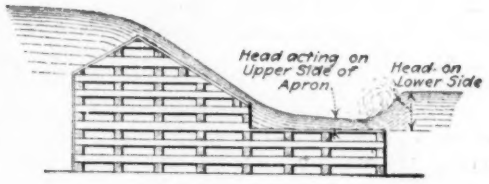
It is a fact that authorities responsible for the maintenance of our bridges usually assume that once a modern structure is erected no further attention is required. This is especially true of an all-protected structure such as the one in question, and the highway department finds it most difficult to make such authorities realize the destructive action of water. As a result most of our bridge failures are due to foundation troubles, and until our bridges are placed in the hands of those who are competent to inspect and repair them, just such accidents are bound to occur.

E. E. BRANDOW,
Bridge Engineer, State Highway Department.
Albany, N. Y.

Uplift from Hydraulic Jump Neglected in Dams on Porous Foundations

Sir—The partial failure of several dams has recently directed the writer's attention to a point usually overlooked in the design of overfall dams. The dams were of the decked crib type, with an apron, as shown in Fig. 1. After passing the crest, the water flowed over the apron in a thin sheet, forming a hydraulic jump at the lower end. The forces acting on the apron are: (a) the force exerted by the water in its change from a vertical to a horizontal direction, and (b) the weight of the water on the apron. The head of water below the jump is transmitted back through the cribs, and acts upward upon the whole of the under side of the apron. At a certain stage of the river at these dams this upward acting force exceeded those acting downward to such an extent that the apron was torn from the cribs.

A somewhat similar case is cited by Frederick P. Stearns, in the Tranactions of the American Society of Civil Engineers, Vol. LXXX, p. 368, in which a flume 40 ft. wide and 13 to 16 ft. deep, was lifted "off its foundation for a considerable part of its length, notwithstanding the fact that it was anchored in some places to the ledge and in other places was fastened to anchors buried 3 ft. below the surface of the ground which supported the sills."



How Dams Failed
FIG. 1

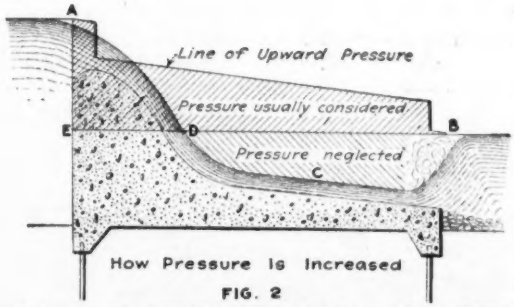


FIG. 2

WHAT THE HYDRAULIC JUMP DOES TO BACK PRESSURE ON DAM APRONS

This action might profitably be considered not only in the design of timber dams but also in the design of concrete dams and in aprons below sluice gates. Consider, for instance, a dam on porous foundations of the general type shown in Fig. 2. If the upward pressure acting upon the dam is assumed to follow the line of creep law, as represented by the line *AB*, the total uplift usually considered in design is represented by the area *ABE*, while the actual uplift would be *ABCDE*.

Arcadia, Fla. E. W. LANE.

Wants Motor Vehicles to Pay for Road Work

Recommendation that motor vehicles should pay license fees sufficient to provide for a large share of the maintenance of roads on the main lines of traffic is made in the annual report of C. M. Babcock, commissioner of highways of Minnesota. The report states that such vehicles are causing much additional expense in the construction and maintenance of the public highways and are not bearing their share of this expense. The present automobile fee is lower than that of any other state. In view of the increase in sizes and weights of motor vehicles legislation is advocated also to limit the wheel loads and sizes, and in general to provide for more regulation of traffic on the public highways.

HINTS FOR THE CONTRACTOR

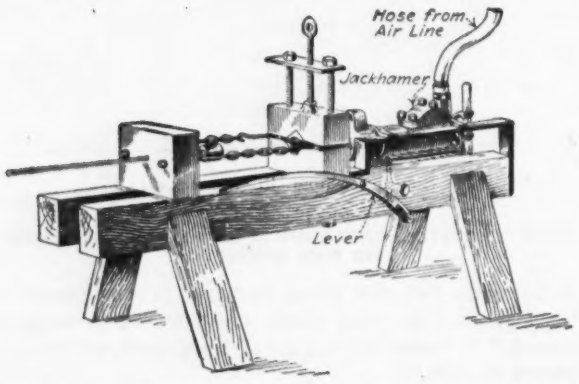
DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Drill Steel Shanked with Home-Made Rig

BY H. A. SITTERLY
Chief Engineer, Low Moor Iron Company, Low Moor, Va.

SHANKING drill steel by a home-made rigging which employs a broken jackhamer as the source of power has been found to be cheaper and productive of more satisfactory results than can be obtained by having a blacksmith weld a ring around the drill steel. Furthermore, while hectagonal hollow steel has been used, no case has been found in which the formation of a shank or collar with this machine has resulted in closing the airhole.

As shown in the accompanying illustration, the rig consists essentially of two 4 x 6-in. timbers about 8 ft. long, which are mounted on trestle legs and carry at one



BROKEN JACKHAMER FURNISHES UPSETTING POWER

end the jackhamer mounted on a slide to allow movements parallel to the bed timbers. The rotating parts have been removed from the jackhamer, since all that is desired is the reciprocating action. The movement of the jackhamer is effected through manipulation of the lever. In front of the "business end" of the jackhamer is mounted a vise provided with metallic jaws through which the drill steel passes and is fastened as indicated. At the other end of the trestle is another block through which passes the screw from an old tripod drill on the near end of which is mounted a dieblock to receive the cutting end of the drill steel. This stanchion is connected with the vise by means of chains and bolts to provide greater stiffness.

In collaring or shanking a piece of drill steel, the end is heated for about 8 in., 4 in. of which are cooled by dipping into water. The rod is immediately clamped in the vise, allowing about 7 in. of the heated end to project toward the jackhamer. By turning the drill screw and tightening the vise, the drill steel is held rigid in place. By manipulating the lever the jackhammer is brought up against the chilled end of the steel, air is turned on, and the collar or shank formed by upsetting the still hot zone. The rig was built from scrap material by T. M. Hill, master mechanic at one of the Low Moor mines.

Bulk Cement Shipped in Open Cars is Unloaded by Grab Bucket

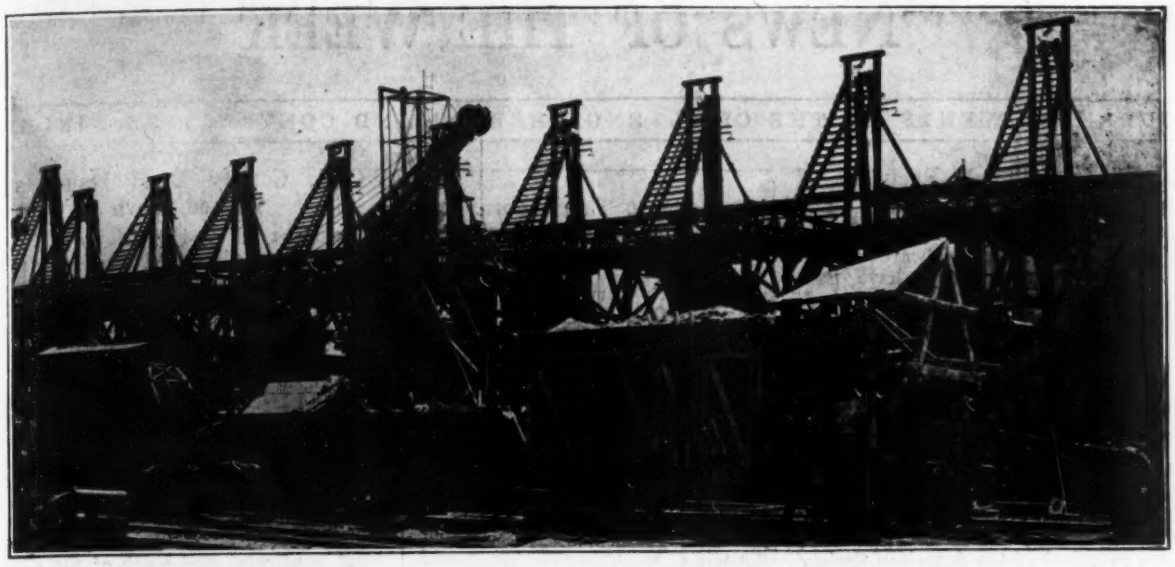
TRANSPORTATION of bulk cement in gondola cars is a novel method which was made necessary in 1917 by the shortage of car supply, and was employed with success by several contractors. The cement was protected from rain, snow and wind by tarpaulins, stretched over frames in the car to form a gable roof. On some small jobs the cement was unloaded by hand shoveling into wheelbarrows, but as a rule it is more economical to use mechanical equipment for this purpose.

The method of handling cement in open cars and unloading it with a grab bucket and locomotive crane is shown in the accompanying view. This represents the concreting plant of the Newton Engineering Co. at the Bay View works of the Illinois Steel Co., Milwaukee, Wis. Here 14,420 barrels of bulk cement were handled by grab buckets. Observation made on a windy day showed very little loss of cement by blowing away or leaking through the closed joint of the bucket, and it is asserted that the Newton Engineering Co. found the loss of bulk cement handled in this way less than the loss with sacked cement.

The portable concreting plant illustrated was for the construction of an ore trough. On the flat car were mounted bins, an inclined belt conveyor, a measuring hopper and a mixer with swinging spout. Above the belt conveyor were separate bins for the sand, stone and cement. Sand and stone were fed by gravity to the belt which delivered them to a measuring hopper alongside the mixer. Cement was shoveled by hand into a measuring box that was directly above this hopper and had its bottom formed by a sliding steel plate. When the charge was ready this plate was pulled out and the cement followed the sand and stone through the hopper into the mixer.

Raw materials were loaded into the elevated bins by the clamshell bucket operated by a locomotive crane traveling on a track alongside that on which the mixer car and material cars were located. The first gondola car, containing the cement, was about 25 ft. from the mixer car. The sand and stone cars were next to the cement car. The tarpaulin was rolled back to uncover the cement as required, and the car was well cleaned out by the man who signaled the clamshell operator, in the same way as that in which he attended to the removal of the sand and stone.

Two methods of distributing concrete were used on this job. Concrete for foundations was discharged from the mixer into a swinging chute extending to the forms



BULK CEMENT DELIVERED TO CONCRETING PLANT BY LOCOMOTIVE CRANE WITH GRAB BUCKET

Concrete for the walls was discharged from the mixer into the bucket of an elevator tower and then raised to such a height that it could be dumped into a hopper and thence spouted into place. This tower was built upon a flat car so that it could be shifted to such position that its bucket could be loaded directly from the mixer.

Give Soft Finish With Brush After Floating Concrete

ALL exterior surfaces of the slabs used by the Unit Construction Co. in building the concrete houses of the Youngstown Sheet & Tube Co., described on page 695 of *Engineering News-Record* of Apr. 11 are soft in appearance. This result is achieved by finishing the surfaces with a brush instead of a trowel. Slabs are floated as usual and then brushed very lightly in two directions, using a wire form brush. The result is a soft, streaked surface which appears whiter than concrete made with the same cement and troweled. The finish has not only been used on the buildings, but also on the curb and gutter work, a specimen of which appears in the photograph.

SOFT FINISH SECURED BY BRUSHING

Typhoid Fever Mortality Rates for 1917

Of 39 cities for which typhoid fever mortality statistics for the year 1917 have been compiled by the health board of Denver, Colo., the best showing is made by Oakland, Calif., with a total of four deaths or 1.9 per 100,000 population. New Orleans has the highest rate, 23.1. In the following table the rates are based on populations estimated for 1917 by the U. S. Census:

Oakland, Cal	1.9	Indianapolis, Ind	10.3
St. Paul, Minn	2.8	Pittsburgh, Pa	11.3
Boston, Mass	2.9	Grand Rapids, Mich	12.1
Rochester, N. Y	3.0	Trenton, N. J	12.6
Camden, N. J	3.8	Paterson, N. J	12.7
Newark, N. J	4.2	Louisville, Ky	13.7
Los Angeles, Cal	4.7	Milwaukee, Wis	5.8
Toronto, Can	4.8	Minneapolis, Minn	5.9
San Francisco, Cal	4.9	New Bedford, Mass	5.9
Denver, Colo	5.2	Lowell, Mass	6.1
Portland, Ore	5.2	Syracuse, N. Y	6.3
Omaha, Neb	5.4	Springfield, Mass	6.6
Providence, R. I	5.4	Lynn, Mass	6.8
St. Louis, Mo	7.5	Dayton, Ohio	14.0
Richmond, Va	8.6	Memphis, Tenn	15.8
Manchester, N. H	9.0	Fall River, Mass	17.0
New Haven, Conn	9.2	Salt Lake City, Utah	18.7
Toledo, Ohio	9.4	Detroit, Mich	18.8
Buffalo, N. Y	10.1	New Orleans, La	23.1
Albany, N. Y	10.3		

Nine of the cities have rates below 5 per 100,000, thus entitling them to a place on the "typhoid honor roll" suggested editorially by *Engineering News-Record* of Oct. 18, 1917, p. 723. The rates given were recomputed from typhoid and other mortality statistics for 1917, given in the Denver *Commercial*, published by the Denver Civic and Commercial Association.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

J. Waldo Smith Is Recipient of John Fritz Medal

For the first time since 1910 the John Fritz medal has been awarded to a man whose achievements have been strictly those of civil engineering. J. Waldo Smith, chief engineer of the New York Board of Water Supply, and builder of the Catskill Aqueduct, was the recipient of the medal Apr. 17 at a meeting in the auditorium of the Engineering Societies Building, New York City. Col. John J. Carty, past president of the American Institute of Electrical Engineers, presided; Nelson P. Lewis and the Hon. A. T. Clearwater made addresses, and Ambrose Swasey, past president of the American Society of Mechanical Engineers, presented the medal.

Nelson P. Lewis, the first speaker, gave a brief outline of Mr. Smith's engineering career, from the time when, while in his teens, he helped to build a small water-works and afterward became its chief engineer, until the present time, when he has successfully completed the first part of the great Catskill undertaking for New York City's water-supply, and is ready to proceed with the further work of connecting the Schoharie watershed into the new water system.

Mr. Lewis mentioned among Mr. Smith's attributes as an engineer his courage, his appreciation of the time element, his organizing ability, his diplomacy and his fairness. Mr. Clearwater, speaking from the viewpoint of the layman, added the qualities of accuracy, veracity, vision and imagination.

Mr. Smith, in accepting the medal, averred that the award must be for the work done by the whole Catskill organization, rather than for his personal achievement. He spoke of the assembling of representatives of the four national societies in 1902, to award the first John Fritz medal to the late John Fritz himself, as the first move toward engineering unity, which, he said, had made such progress in the past two years.

Canadian Government Pools Power to Supply Munitions Plants

The munitions plants dependent upon electric power generated at Niagara have been handicapped by a serious power shortage estimated at 21,000 hp. In view of this situation, the Canadian Government has issued an order in council providing for the pooling and distribution of all power resources. The distribution will be directed by Sir Henry Drayton, controller of electric energy, regardless of existing contracts, and priority will be given to munitions plants. Power companies which have steam generating plants are ordered to operate them at full capacity. It is expected that the execution of the order will make up the deficiency in the power supply.

Message to Engineers From France Is, "We'll Stand Fast"

Special cable from R. K. Tomlin, Jr., War Correspondent of Engineering News-Record

In the world crisis precipitated by the German onslaught in Picardy and Flanders the faith of France in her own armies and those of her allies remains absolutely unshaken. This is the clear-cut impression gained by the observer in Paris today. There is no panic here as Teuton propagandists would have the world believe, nor are there discernible even the symptoms of a general uneasiness.

Long range shelling by day, bombing raids from the air by night, and the threat of a German advance upon the French capital, far from demoralizing the spirit of the civil population, have lifted it to new heights of determination and confidence. The daily news from the front is even more encouraging, and there are just beginning to drift back hints of the heroic part which the engineers of the allied forces are playing in the greatest war drama of all time.

When the full story is told of how they have been performing, day after day, seemingly impossible feats in transporting reserve troops and material, and in maintaining lines of communication, it will form the grandest epic in the annals of engineering.

From the picture of public feeling here I will pick out a single detail. At the *pension de famille* where I stay lives the aged widow of a French general. Amid the bursting shells of the long-range gun, bombs dropped in the night and early rumors of an overwhelming German attack, her friends attempted to persuade the old lady to leave Paris. I saw her eyes flash, her bent shoulders straighten back and as she snapped, "Reste ici," she seemed to embody in those three words the spirit of France, "We'll stand fast."

Cook County Bond Issue Is Turned Down

County roads in the vicinity of Chicago will be built only on contracts already let, because the Capital Issues Advisory Committee has declined to sanction the selling of the million-dollar bond issue voted last fall. The Department of Agriculture advised the local committee that there is not sufficient agricultural necessity for the roads, and the War Department asserted that there is not sufficient military improvement to justify building them. This bond issue was to have been used in the construction of 48 miles of road along five routes northwest, southwest and south of the city.

Navy Orders Eight Concrete Barges

Contracts for eight concrete barges have been let by the Bureau of Supplies and Accounts for use in the navy yards on the Atlantic coast. Four of the barges are to built by the Amboursen Construction Co. at $21,950 each, and four by Louis L. Brown, Inc., at $24,700 each. Both the above firms are located in New York City, to which place delivery is to be made.

These barges are 500 tons dead weight cargo vessels to carry coal on deck within flash-boards and oil in compartments below deck. Bids had been asked on 12 barges from 35 selected firms, each bidding on its own design with restrictions as to general requirements.

Politician Made Commissioner of New York's Water Board

L. J. O'Reilly, private secretary of William R. Hearst, and prominent in the direction of the political activities of Mr. Hearst, on Apr. 23 was appointed commissioner of the Board of Water Supply by Mayor Hylan of New York City. Mr. O'Reilly succeeds Charles Strauss, who resigned recently. In his letter of resignation Mr. Strauss said the $12,000 office was unnecessary because all the work that called it into existence during the McClellan administration had been accomplished.

Engineering Works Escape in Severe Quakes on Pacific Coast

Earthquake shocks in southern California and western Arizona occurring Apr. 21 and 22 are reported to have destroyed about 40 one- and two-story buildings in Hemet and San Jacinto, two inland towns east of Los Angeles. The damage in these two towns is estimated at about $500,000. The Los

Angeles Water Department states that the aqueduct and water system are intact. No reports of serious damage to engineering structures have been received.

Avoid the Rush—Come Early

The following advertisement appears in the *Windy City Echo*, a paper edited in France by the 13th Engineers (Ry.) U. S. Amexforce, in France. This regiment was recruited in Chicago and is said to be the first engineering regiment to arrive in France.

WINDY CITY
Somewhere in France
Convenient to Hill 13
THE HOME OF THE HAIRTRIGGER 13TH ENGINEERS
(The Lucky 13th)
Population, Including Rats, Rabbits and Three Dogs, 7000
Well-Paved Streets
Water (Plain, Fancy, River and Rain)
Police Department and Sanitary Jail
Convenient Cemetery and Commodious Morgue
Sewer Without System
Free Transportation to the Front—None to Paris
Attractive Forest of Beautiful Trees and One Bush, Covered with Leaves of Absence, With and Without Permission
Unparalleled Mud Baths
Magnificent View of Railroad Yards and Water Tanks
AMUSEMENTS—ALL FREE
Rat-Hunting Contests
Dugout Races
Trench Swimming
Aeroplane Raids
Music (Trench) at All Hours
DESIRABLE BUILDING SITES FOR SALE ON ALLOTMENT PLAN
INDIVIDUAL LOTS, 6 x 2 x 6 FEET, FOR PERMANENT ABODE, FURNISHED FREE
Choice Bungalows for Rent, with All Modern Conveniences Except Water, Light, Heat, Floors and Bathroom
Knotholes Provided for Rain Drops
Ventilation Unexcelled
Hospital on Grounds—a Pill for Every Ill
"If you wish to live where things are pretty,
Just make your home in the Windy City."
For particulars, apply to
13th Engineers Amexforce

War Board to Have Fire Protection Head

Protection of all Government structures and war industries against destruction by fire is to be promoted by the recent formation of a fire prevention section of the War Industries Board, under the direction of W. H. Merrill, president of Underwriters' Laboratories, in Chicago.

Part of the work of the new section is the procuring of information on the conditions as to fire hazards existing in plants manufacturing munitions and providing adequate protection where surveys show plants working on Government contracts to be poorly guarded against possible fire loss. State fire marshals, municipal fire prevention bureaus, insurance boards, bureaus, associations, companies, in fact all existing fire prevention organizations, are being enlisted by the section in a coöperative effort to avoid interference with the Government's program by fires in munition plants and elsewhere.

Illinois Structural Engineers Obtain Recognition

Passage of an amendment to the Chicago building ordinance authorizing the issue of building permits to licensed structural engineers as well as to architects, has resulted recently from the efforts of the Structural Engineers' Assn. of Illinois, as announced at the annual meeting in Chicago, Apr. 17. The association has had a conference also with the state officials in regard to the selection of members of the new examining board for the licensing of structural engineers, and it will attempt to obtain a reduction of the annual state tax for renewal of license from $10 to $5.

The desirability of prevention rather than cure was the theme of the address by the president, J. G. Giaver, the idea being that it is better to watch and guide restrictive regulations than to have to cure adverse conditions. Structural design of ships, as exemplified in the reconstruction of the steamship "Eastland," was discussed by Capt. Edward A. Evers, commanding the Illinois Naval Reserve of the U. S. Navy. The disastrous capsizing of this crowded excursion boat in the Chicago River a few years ago was due to a top-heavy condition, a crowding of the passengers to one side, and the accidental filling of the trimming tanks on that side instead of those on the opposite side. The design of the hull was good, and the boat as now cut down is a twin-screw destroyer.

Besides electing directors, who will elect the officers later, the association voted to reduce its annual dues from $10 to $5. John P. Cowing, Chicago, is secretary.

Reconstruction Mission to Palestine Includes Engineers

The American National Red Cross has announced that a commission of about sixty members, including a number of noted engineers from the United States, will make a study of conditions in Palestine for reconstruction purposes, and to assist in giving the people of that section relief from typhus, disease and famine, as well as to assist in providing housing, if necessary.

The commission, with the exception of a few members, is believed to have arrived in Palestine, as it left this country some weeks ago. It is expected that Dr. John H. Finley, commissioner of education of the State of New York, will head the commission. The three sanitary engineers in the party are Harry V. Carson, Central Foundry Co., New York City; Gilles S. Pease, Worcester, Mass., and William C. Groeniger, Columbus, Ohio. Two electrical engineers are in the party. They are Arthur A. Bacon, Hobart College, Geneva, N. Y., and Julius A. Brown of Columbia University, New York City.

Engineering Council Acts on Labor Legislation

Passes Resolutions Opposing Clause in Army and Navy Appropriation Bills to Abolish Bonus

Opposing the provision in the pending Army and Navy appropriation bills which would prohibit payment of bonuses to public employees or employees of establishments under Government control, the Engineering Council, at a meeting in New York Apr. 22, adopted, and transmitted to each member of the Senate committees on naval and military affairs, this resolution:

"Whereas, the winning of the war imperatively demands highest efficiency and maximum production in every branch of industry, and

"Whereas, we are informed that Congress has under consideration in the Naval and Army appropriation bills proposals to prohibit, diminish and condemn the payment to public employees or to employees of private establishments under Government control any cash reward, premium or bonus for superior service, and

"Whereas, these methods if applied with due regard to wages, surroundings, health and safety of the employees, will increase efficiency and production, help win the war and preserve our institutions, be it, therefore,

"Resolved, that in the opinion of Engineering Council, representing American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers and American Institute of Electrical Engineers, together having 33,000 members, it is vital to the winning of the war that no legislation nor other measure should be adopted which may interfere with highest efficiency and maximum production, but that on the contrary every proper means should be taken to increase efficiency and production.

"J. PARKE CHANNING,
"Chairman, Engineering Council."

It is stated by Alfred D. Flinn, secretary of the Engineering Council, in making public the resolution, that a careful reading of the third preamble will show it to be the belief of the council that the best interests of the workmen should be conserved in endeavors to get the maximum production for winning the war, and that the methods proscribed in the bills referred to, as well as other methods to stimulate production, should be adopted under proper safeguard for the interests of the workmen and the Government.

Army Engineer Regiments Now Being Recruited

Men Are Wanted for Different Kinds of Service as Privates and Non-Commissioned Officers

Opportunities for engineers to enlist in the army for active service abroad are now afforded in almost as many kinds of service as there are kinds of engineers. Regiments with special designations are being recruited in different parts of the country and are being trained in their duties preparatory to being sent abroad. There is given in the accompanying table a list of all such regiments, together with their designations and their present location.

This list comprises all the units for which enlistments are accepted at recruiting stations. Enlistments, however, are confined to qualified men between the ages of 18 and 40 *who are not registrants under the Selective Service Law.* By special and recent order men subject to the draft cannot be voluntarily inducted into the service, except when specially authorized by the War Department, and then only in limited numbers and for a few organizations. Any registrant under the draft who desires to enter the service ahead of the normal operation of the draft should file with the Chief of Engineers an application giving his address, draft status, age, education, training and experience. Should occasion arise, these applications will be considered for the regiments now being recruited.

Regular recruiting offices are not allowed to accept men outside the draft limits for some of these regiments without preliminary approval of certain engineer officers. Thus for those regiments marked in the table with one star, applications for enlistment will not be entertained by the recruiting officer unless the individual presents an authorization card issued by the Office of the Chief of Engineers or by a commissioned officer of the unit. For those marked with two stars there is necessary an authorization card issued by the Office of the Chief of Engineers or by the General Engineer Depot Officer.

Except in very special instances where men of rare talent and ability are wanted, no men will be commissioned from civil life directly into the Corps of Engineers. There are now open but two ways to such a commission. One is the coming examination for second lieutenant in the Corps of Engineers, U. S. A., to which are eligible unmarried men of technical education and training, between the ages of 21 and 29. Information on that examination can be had from the Chief of Engineers, Washington, D. C. The other is enlistment in the coming officers training camp, which is open mainly to privates and noncommissioned officers in the army or qualified technical students, but to which will also be allowed a certain number of qualified civilian engineers. These men will have to go through the regular training camp routine, and take their chances on getting a commission at the end, the rank to depend on their ability. Information concerning this may also be obtained from Washington

ENGINEER REGIMENTS NOW BEING RECRUITED

No. of Regiment	Character of Service	Location
———	Provisional Sapper Reinforcement Regiment	Washington Barracks, D.C.
22nd*	Light Railway Operating	Camp Sheridan, Ala.
26th	Water Supply	Camp Dix, N. J.
27th	Mining	Camp Meade, Md.
28th	Quarry	Camp Meade, Md.
29th*	Mapping	Camp Devens, Mass
30th	Gas and Flame	Fort Myer, Va.
31st*	Railway Operating	Ft. Leavenworth, Kans.
32nd*	Railway Construction	Camp Grant, Ill.
34th	Supply and Shop	Ft. Benjamin Harrison, Ind.
37th*	Electrical and Mechanical	Fort Myer, Va.
38th*	Crane Operators	Fort Myer, Va.
39th*	Railway Operating	Camp Upton, L.I. N. Y.
44th*	Railway Maintenance of Way	Ft. Benjamin Harrison, Ind.
45th*	Railway Maintenance of Way	Camp A. A. Humphreys, Va.
46th*	Railway Maintenance of Way	Camp Sheridan, Ala
47th*	Railway Maintenance of Way	Camp Sheridan, Ala
48th*	Railway Maintenance of Way	Ft. Benjamin Harrison, Ind.
49th*	Railway Maintenance of Equipment	Fort Myer, Va.
50th*	Railway Maintenance of Equipment	Laurel, Md.
51st*	Railway Miscellaneous Trades and Storekeepers	Camp Lee, Va.
52nd*	Railway Operating	Camp Upton, L. I.
53rd*	Railway Operating	Camp Dix, N. J.
54th*	Railway Operating	Camp Dix, N. J.
55th*	Railway Construction	Camp Custer, Mich.
56th*	Searchlight	Washington Barracks, D.C.
57th	Inland Waterways	Laurel, Md.
60th*	Railway Operating	Ft. Benjamin Harrison, Ind.
61st*	Railway Operating	Ft. Benjamin Harrison, Ind.
62nd*	Railway Operating	Ft. Benjamin Harrison, Ind.
63rd*	Railway Operating	Ft. Benjamin Harrison, Ind.
66th*	Railway Operating	Laurel, Md.
402nd**	Depot Detachment	San Antonio, Tex.
403rd**	Depot Detachment	Vancouver Barracks, Washington
404th**	Depot Detachment	Ft. Leavenworth, Kansas
405th**	Depot Detachment	Camp Devens, Mass
406th**	Depot Detachment	Camp Upton, L. I., N. Y.
407th**	Depot Detachment	Camp Dix, N. J.
408th**	Depot Detachment	Camp Meade, Md.
409th**	Depot Detachment	Camp Lee, Va.
410th**	Depot Detachment	Camp Jackson, S. C.
411th**	Depot Detachment	Camp Gordon, Ga.
412th**	Depot Detachment	Camp Taylor, Ky.
414th**	Depot Detachment	Camp Custer, Mich.
415th**	Depot Detachment	Camp Grant, Ill.
416th**	Depot Detachment	Camp Pike, Ark.
417th**	Depot Detachment	Camp Dodge, Iowa
418th**	Depot Detachment	Camp Funston, Kansas
420th**	Depot Detachment	Camp Lewis, Washington
421st**	Depot Detachment	Camp Wadsworth, S. C.
422nd**	Depot Detachment	Camp Hancock, Ga.
423rd**	Depot Detachment	Camp McClellan, Ala.
424th**	Depot Detachment	Camp Sevier, S. C.
425th**	Depot Detachment	Camp Wheeler, Ga.
426th**	Depot Detachment	Camp McArthur, Tex.
427th**	Depot Detachment	Camp Logan, Tex.
428th**	Depot Detachment	Camp Cody, N. Mex
429th**	Depot Detachment	Camp Doniphan, Okla.
430th**	Depot Detachment	Camp Bowie, Texas
431st**	Depot Detachment	Camp Sheridan, Ala
432nd**	Depot Detachment	Camp Shelby, Miss.
433rd**	Depot Detachment	Camp Beauregard, La.
434th**	Depot Detachment	Camp Kearney, Cal.
435th**	Depot Detachment	Camp Greene, N. C.
436th**	Depot Detachment	Corozal, Canal Zone
437th**	Depot Detachment	Washington, D. C.
438th**	Depot Detachment	Port of Embarkation N. Y. City
439th**	Depot Detachment	Port of Embarkation Norfolk, Va.
440th**	Depot Detachment	Philadelphia, Pa., 607 Manhattan Life Bldg.
441st**	Depot Detachment	Baltimore, Md., Coca-Cola Bldg.
470th*	Depot Detachment	Camp Fremont, Cal.
471st*	Depot Detachment	Camp A. A. Humphreys, Va.
601st*	Corps Regiment	Camp Laurel, Md.
602nd*	Corps Regiment	Camp Devens, Mass.
603rd*	Corps Regiment	Ft Benjamin Harrison, Ind.

New York Barge Canal Taken by Government

Director of Railways To Build and Operate Barges on Largest Artificial Waterway

On Apr. 17 Director General of Railways McAdoo ordered the taking over of the New York State Barge Canal system by the Railroad Administration. It was announced that under the direction of G. A. Tomlinson, of Duluth, Minn., a fleet of large barges would be constructed immediately and operated throughout the length of the canal. According to the official announcement, several hundred steel barges of about 700 tons each are to be ordered immediately, to be built on the Great Lakes at an approximate cost of $60,000 each. The barges are to be of such size as can be operated in groups of four with one self-driven barge to control the group. A part of the announcement is that the first of these barges can be completed in five or six weeks.

Mr. Tomlinson, who is to take charge of the canal operation, is a member of the inland waterways committee of the Railroad Administration and a man of long experience in lake shipping. Some weeks ago he offered to construct on his own responsibility a large fleet of barges and operate them on the Barge Canal in connection with lake fleets in which he is interested. His proposition, however, was contingent upon the Federal Government's remaining out of the canal operation.

The Barge Canal, it is now confidently expected, will be open for through navigation from Lakes Erie, Ontario and Champlain to the Hudson River at Troy by the middle of May. It is possible that construction may hold up the opening of the western branch—that is, the part extending from Syracuse to Buffalo—until somewhat later in the spring, but in any event the line from Lake Ontario to Oswego to Syracuse and thence down the Mohawk Valley to the Hudson will be open at an early date. Besides the barges to be built by the Government, there appear to be only a half dozen large barges under construction or ready for use on the Barge Canal.

It is understood in Washington that

the taking over of the Barge Canal is only the first step in the Government control of a number of other artificial waterways, those most under consideration being the Chesapeake & Ohio Canal, which extends down the Potomac Valley to Washington, and the Warrior River system in Alabama.

Ship Line On Great Lakes Established by McAdoo

Railroad Administration Will Operate Seven Large Steamships to Relieve Trunk Lines

To relieve the car situation as much as possible, the Director General of Railroads has established a lake line between Chicago, Milwaukee and Buffalo. With the opening of lake navigation it is planned immediately to release cars that have been held up on Western railroads by the congestion on the Central roads and to move the loads east by lake and railroad routes for delivery to points east of Buffalo, thereby releasing equipment to the Western railroads.

It is expected that shippers of heavy staple commodities from the East will take advantage of this service on account of its steady and regular movement. Seven large modern steamships will be assigned to this lake-line service. It is intended to work day and night shifts at terminal points to cut down demurrage to the lowest amount possible, thereby affording the greatest relief to the railroads.

The new lake line will be known as the Lehigh Valley Transportation Co. and will serve all Eastern trunk lines through a common terminal at Buffalo, N. Y.

Two of the ships assigned were owned by the Lehigh Valley R.R.; the others were chartered from the Great Lakes Transit Corporation. Additional ships will be added as the service requires. All-rail rates will prevail in both directions, so that in case of congestion on the railroads the freight can be immediately diverted to the lake line and given continuous movement to destination. The rates include marine insurance. It is expected that the service will be of great assistance to shippers.

How the War Has Increased One Department

What the war means in added burden on the departments at Washington may be partly surmised by the following official statement issued recently by the Committee on Public Information:

"At the outbreak of the war the gun division of the Bureau of Ordnance of the War Department was composed of three officers and seven civilians. At the end of the year 1917 it had approximately 500 officers and 3500 civilians, and by June, 1918, it is estimated there will be 1500 officers and more than 10,000 civilians in this division.

Hurley Reports on Nation's Progress in Shipbuilding

United States Now Has 398 Ways for Building Steel Vessels, with 332 for Wooden Construction

Among the most interesting features of the speech which Edward N. Hurley, chairman of the United States Shipping Board, delivered recently before the National Marine League, were his statements as to what has been accomplished in the direction of output of vessels. According to Mr. Hurley there were 37 steel shipyards in America at the time of our entrance into the war. Since then 81 yards for the building of steel and wooden ships have been located, while 18 other yards have been expanded.

We were building in the new and expanded steel yards 235 new steel ship ways, or 26 more than at present exist in all of the steel shipyards of England. As an evidence of our progress Mr. Hurley referred to the record made by a Seattle company, which launched an 8800-ton vessel 64 days after the laying of the keel. This ship was delivered to the Fleet Corporation on Jan. 5 and started on her first voyage on Jan. 14.

An Oakland, Cal., concern, Mr. Hurley said, had launched successfully three 9400-ton vessels in one afternoon.

Total Construction on March 1

The total amount of our steel construction on March 1 was 8,205,708 deadweight tons, made up of 5,160,300 tons under contract with the Emergency Fleet Corporation and 3,045,408 tons of requisitioned vessels.

Approximately 28 per cent. has been completed. In other words, the program for steel ships has advanced 28 per cent. toward completion. Of the amount of steel ships under contract and under requisition approximately 8 per cent. were actually completed on March 1. This amount of floating tonnage exceeds our total output in 1916, including steel, wooden and sailing vessels, by approximately 50 per cent.

Referring to the German ships in American ports which were taken over and found to be crippled by their enemy crews, Mr. Hurley said: "With the expenditure of a little less than $8,000,000 we have succeeded in placing in our war service and in the service of the Allies 112 first-class German and Austrian vessels, representing a carrying capacity of nearly 800,000 deadweight tons."

As to the development of our shipyards, the 37 old steel yards now have 195 ways, as against 162 eight months ago. Other parts of their plants have increased proportionately. Thirty new additional steel shipyards are being erected with a total of 203 ship-building ways. Thus we now have, in the aggregate, 67 steel shipyards either wholly or partly engaged in Fleet Corporation work. These yards will have a total of 398 steel building ways.

Of these yards, 35, with 258 ways, are on the Atlantic and Gulf Coast; 19, with 66 ways, are on the Pacific Coast, and 13, with 74 ways, are on the Great Lakes.

Wooden Ship Facilities

In addition, the capacity for wooden ship building has been increased until we now have 81 such yards with 332 ways completed or near completion. Mr. Hurley estimates that our output of wooden ships will approximate 2,300,000 deadweight tons annually.

The 332 wooden ship-building ways added to the 398 steel building ways give a total of 730 berths on which to build steel and wooden vessels—an increase of 495 within a few months.

The delays that have occurred in the turning out of ships Mr. Hurley attributed largely to the slowing up of railroad transportation, more especially as the method of producing ships today is one of assembling rather than of constructing all the parts at any one point.

Delay has also arisen because of the unprepared condition of the turbine and engine manufacturers. Here, again, construction has been delayed by lack of transportation facilities. Mr. Hurley said, however, that the board expects to make up for the shortage.

The first concrete steamship, recently launched, gave promise of being a success, he stated.

As to the number of employees in shipyards, Mr. Hurley stated that whereas in 1916 there were less than 45,000 men employed in all the shipyards of the country, on March 2, 1918, the number had increased to 236,000, of whom 170,589 were working on actual shipping construction. In addition, the board has recruited a volunteer force of 250,000 highly skilled mechanics, who have agreed to hold themselves in readiness for a call.

Government Will Build Another Agency Shipyard

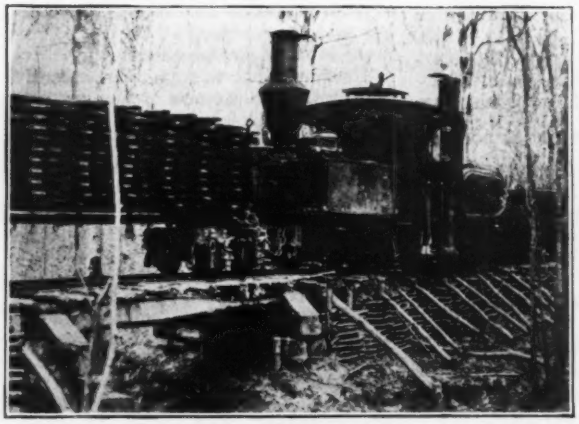
The Emergency Fleet Corporation has let a contract to the Carolina Shipbuilding Co. for the construction of a new shipyard at Wilmington, N. C., and for 18 steel ships to be built at the yard. The contract is the agency form similar to that for the three big yards now building Government ships at Hog Island, Bristol, Pa., and Port Newark, N. J., where the agents are, respectively, the American International Shipbuilding Corporation, the Merchants Shipbuilding Corporation, and the Submarine Boat Corporation. Under this form of contract, the Government assumes all costs and has ownership of the yard, the contractor merely acting as agent for the construction of both yard and ships.

The new contractor is a subsidiary of the George A. Fuller Co., which has a number of contracts for other Government work, mostly buildings. At its new yard there will be six ways, on which will be turned out 9,600-ton fabricated steel ships.

The American Engineer Has Made Great Progress in France—Buy Liberty Bonds to Keep Him at Work, and He Will Assure Our Victory

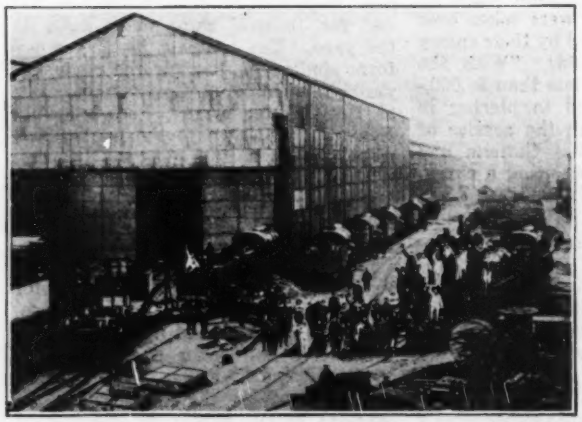
HEAVY TRUCK AND TRAILER DISCHARGE BARRACKS SECTIONS AT AMERICAN BASE IN FRANCE

OUR ENGINEERS TEST WITH SAND-BAGS BRIDGE THEY HAVE BUILT OVER FRENCH STREAM



RAILWAY IN FOREST OF PARROY—CAR LOADED WITH SECTION OF NARROW-GAGE TRACK

ARMY TRUCKS IN SUPPLY BASE READY TO LOAD UP FOR TRIPS TO AMERICAN LINES



PLANT AT WHICH AMERICAN LOCOMOTIVES ARE ASSEMBLED IN FRANCE

GERMAN PRISONERS GRADE RAILROAD BEHIND AMERICAN LINES

Photographs © Committee on Public Information

War Reactions Reflected in Water-Works Meeting

Despite the active participation of nearly half of the members in war activities, the tenth annual meeting of the Illinois section of the American Water-Works Assn., at Urbana, brought 40 men together. Water waste prevention, unusual winter problems, coal storage, rising costs, availability of maintenance and operating materials, and war activities of the members, were the principal topics discussed.

Howard Ely led a round-table discussion on the increased cost of materials and difficulty experienced in obtaining them. A repetition of the stories told at the convention of the Indiana Sanitary and Water Supply Assn. followed. W. F. Montfort, reviewing the chemical situation, held out no hope for reductions, as chlorine, alum and lime are directly or indirectly vital to the prosecution of the war. He strongly advised the purchasing officials to stick to their regular supply houses, otherwise they would be likely to find their deliveries decidedly irregular. Chlorine shipments have been coming through much faster during the past two weeks, according to a representative of Wallace & Tiernan.

Priority of all materials necessary for the maintenance and operation of public water supplies was the subject of a resolution asking the parent association to seek the necessary order. On Mar. 28 priority was obtained for chemicals only for use in public water purification plants, and consigned to municipal authorities. Some of the officials of private companies were apprehensive of difficulties should a strict interpretation of the latter clause be enforced.

Rockaway Valley Sewage Plans Approved

Plans for the diversion of sewage of Rockaway Valley towns to a point below the Boonton dam of the Jersey City water-supply, and treatment of the sewage there by the activated-sludge process, were approved by the New Jersey State Department of Health Apr. 9. A trunk or intercepting sewer 15 in. in diameter will begin at the Wharton line and extend through Dover, Rockaway and Boonton to the disposal works, conducting there the sewage of the four municipalities mentioned. At its lowest end the trunk sewer will have a carrying capacity of 6,000,000 gal. The sewer will parallel the Rockaway River. An abundance of power at the dam is available for providing compressed air for the activated-sludge plant. The plans provide a sludge chamber in which it is proposed to digest the sludge before it is discharged onto the sludge bed. The estimated cost of the trunk sewer and disposal works is $910,000. This cost is to be met by Jersey City, which proposes to use for the purpose the surplus money in its water department fund. The estimated cost of lateral sewers in the four towns already mentioned is about $900,000. The plans outlined have been prepared by Clyde Potts, 30 Church St., New York City, who is also engineer for the lateral sewers proposed by Boonton and Dover. M. I. Fagen is commissioner of streets and public improvements of Jersey City and since assuming office a few months ago has pushed this project, which had been dragging for years.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN WATER-WORKS ASSOCIATION; 47 State St., Troy, N. Y.; May 13-18, St. Louis, Mo.

AMERICAN ASSOCIATION OF ENGINEERS; 29 South La Salle St., Chicago; May 14, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS; 29 West 39th St., New York; Spring meeting, June 4-7, Worcester, Mass.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS; 129 York St., Brooklyn, N. Y.; June 19-22, Berlin, N. H.

AMERICAN CONCRETE INSTITUTE; 27 School St., Boston; June 24-26, Atlantic City, N. J.

AMERICAN SOCIETY FOR TESTING MATERIALS; University of Pennsylvania, Philadelphia; June 25-28, Atlantic City, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS; 29 West 39th St., New York; Atlantic City, June 26-28.

Charles Evan Fowler, consulting engineer, of New York, on April 11 addressed the members of **The Engineers' Club of Trenton** on "Long Spans and Deep Foundations."

The annual meeting of the **National Fire Protection Assn.** is to be held in Chicago, May 7-9. The nominating committee has reported the name of F. J. T. Stewart, of the New York Board of Fire Underwriters, for president for the ensuing year.

At the meeting Apr. 24 of the **Municipal Engineers of the City of New York** a paper entitled, "Reinforced Concrete Pipe" was presented by George C. Bartram, recently with the Lock Joint Pipe Co. The paper was illustrated with lantern slides.

The Engineers' Club of Philadelphia will hold a special meeting at Witherspoon Hall, Apr. 29, at which a paper on "The Social, Political and Industrial Revolution of China" will be read by Dr. Frederic Poole. Dr. Poole's story of China's modern progress and the ability of the Chinese to compete with the Western world will be illustrated by color slides and motion pictures taken by him during a recent journey through the provinces of China as the guest of the provincial viceroys. Preceding the address, Dr. Poole, in full Mandarin costume, will present an illustrated description of the "Humors of the Chinese written language."

At the meeting Apr. 23 of the **Albany Society of Civil Engineers** an illustrated address on "The Disposal of Municipal Refuse" will be given by Theodore Horton, chief engineer of the New York State Board of Health.

At the meeting Apr. 15 of the **Engineers' Club of Chattanooga, Tenn.**, John Y. Bayliss, district engineer, division of valuation, Interstate Commerce Commission, delivered an address on the Madeira-Mamore Ry., in Brazil, a remarkable piece of engineering work.

The next meeting of **The Texas Association of Members of the American Society of Civil Engineers** will be held at the Agricultural and Mechanical College of Texas, at College Station, May 9-10.

A "get-together meeting" of the **Northwestern Society of Highway Engineers** was held in Seattle, Wash., Apr. 12-13. Approximately seventy engineers, members of the organization, were in attendance. While a considerable portion of the sessions was devoted to the reading and discussion of papers on highways and highway construction, the real reasons for the meetings were, first, acquisition of new members, second, publicity for the organization and third, the assembling of the members of the society for the purpose of becoming acquainted. The society was organized in Portland, Ore., Apr. 9, 1917, by Oregon engineers who appreciated the real necessity of coöperation between the engineers of the Northwest if the best results were to be obtained. The membership has grown from 38 to 136, and it is hoped to increase it to at least 500. Headquarters are in Portland, Ore. The president is Herbert Nunn, state highway engineer, Salem, Ore.; the secretary is C. G. Reiter, Hillsboro, Ore.

The Madras, India, Local and Municipal Engineers' Assn. has been organized by engineers and assistant engineers of the district boards and municipalities in the Madras Presidency, for the exchange of ideas and the improvement of work done under the various local boards. The members are largely native engineers. At a recent meeting hill roads with grades steeper than 5% were opposed, as they are hard on traffic and difficult to maintain. Bridges of pile bents with reinforced-concrete slab decks were advocated for crossing irrigation ditches and streams in wet alluvial soil. A 6-in. bed of impervious earth is better than sand for road foundations in black cotton soil, said one speaker, who explained that many massive temples and other heavy buildings have a 24- to 36-in. bed of

such material between their foundations and the black soil. Unless such an impervious covering is used the road material will sink into the soil and disappear during the wet season. The president of the association is K. Krisna Nayar, district board engineer of Malabar; the secretary is Sitaram Aiyar, district board engineer, Vellore.

PERSONAL NOTES

JOHN F. BIRNEY, who for four years was county engineer of Snohomish County, at Everett, Wash., has been appointed chief assistant to J. M. McCaw, county engineer, Whitman County, at Colfax. Mr. Birney is a past president of the Washington State Association of Engineers.

ROBERT A. BOOTH, Eugene, Ore., has been appointed as the new member of the Oregon State Highway Commission to succeed E. J. Adams, whose term expired Mar. 31.

LOUIS SCOTT, field engineer in the county engineer's office, Jersey City, N. J., will occupy a position as field engineer with the State Highway Department, Trenton, N. J., on May 1.

GEORGE C. OXER, who has been supervising engineer for the Braden Copper Co., New York City, is now associated with Col. Hugh L. Cooper on the Muscle Shoals Dam project, Alabama.

K. H. TALBOT, formerly division engineer of the Universal Portland Cement Co. at Pittsburgh, has been commissioned first lieutenant in the Quartermaster Corps, U. S. A., and is now stationed at Harrisburg, Penn.

JOHN W. HERBERT, Helmetta, N. J., a member of the New Jersey State Highway Commission, was at its last meeting elected president for the ensuing year.

ISAAC S. WALKER was appointed Apr. 1 assistant engineer in charge of the sewage disposal division, bureau of surveys, Department of Public Works, Philadelphia, to fill the vacancy caused by the departure of W. L. Stevenson, who, as noted in *Engineering News-Record* of Apr. 11, p. 740, has accepted a position with the U. S. Shipping Board. Mr. Walker has been connected with the bureau of surveys since October, 1916, as assistant engineer in charge of design. He was formerly a member of the staff of Hering & Fuller, and that of Hering & Gregory, consulting engineers, New York. Prior to 1910 he was engaged with the bureau of filtration, Philadelphia, for nine years, on the construction of filtration works.

W. H. MERRILL, president of the Underwriters' Laboratory, Chicago, has been appointed section committee chairman of the newly organized fire prevention section of the war industries board of the Council of National Defense. Mr. Merrill is now in Washington to assume the duties of the new position for the period of the war.

J. W. ADAMS, city engineer of Chatham, Ont., has resigned to go into business at Windsor, Ont.

NORMAN P. GERHARD, for ten years assistant engineer, Board of Water Supply, City of New York, has accepted a position as resident engineer for James H. Fuertes, consulting engineer, at Cumberland, Maryland.

HOWARD STILLWELL, formerly engineer with the Solomon-Norcross Co., consulting engineers, Atlanta, Ga., and associated with P. H. Norcross, supervising engineer in the construction of the army cantonments near Columbia, S. C., is now engineer in the electrical and inspection department of the South-Eastern Underwriters' Assn., Atlanta.

EDMUND G. SIMONS, assistant transit commissioner of Pittsburgh, has been called into active service as first lieutenant, Engineer Reserve Corps. After being graduated from Union College, in 1905, Mr. Simons spent eleven years in construction work, including three years of railroad building in China. The remaining two years since 1905 have been spent in making studies for the relief of transit problems in Chicago and Pittsburgh.

A. G. DALZELL, assistant city engineer of Vancouver, B. C., has resigned. Mr. Dalzell, who is secretary of the Vancouver branch of the Engineering Institute of Canada, has had charge of important sewer design and construction for the city for the past six years.

C. BRAKENRIDGE has resigned from the position of deputy city engineer at Vancouver, B. C., and will open an engineering office in that city.

KIRBY S. HECK has been appointed city harbor engineer of Fruitvale, Calif. Mr. Heck has been employed for many years in government engineering work, and has been in California since returning from the Philippines, where he was in charge of engineering for the Bureau of Public Works of Manila.

MORSE W. REW has resigned from the position of chief engineer of the Pittsburgh Transit Commission to become an assistant to A. M. Taylor, who is in charge of the division of passenger transportation of the Emergency Fleet Corporation. Mr. Rew is a graduate of Grinnell College, Iowa, and of the Massachusetts Institute of Technology. After completing his course at the latter institution, in 1909, he remained two years as an instructor in civil engineering. After this he held positions as designing engineer in the department of bridges, and in the port director's and transit commission's offices, Boston. From Boston Mr. Rew went to Cincinnati as designing engineer for the transit commission, later becoming principal assistant, which position he resigned in 1916 to become chief engineer of the Pittsburgh Transit Commission.

J. PERRY SHUMAKER, recently city engineer of Xenia, Ohio, has accepted a position with the Sherman Engineering Co., Toledo, Ohio, and will take charge of completing paving work in Sidney, Ohio.

O. S. MAPLE, formerly purchasing assistant of the United States Shipping Board, Emergency Fleet Corporation, at Washington, D. C., has recently been appointed assistant purchasing officer of the corporation.

BURNETT HAMILTON, who has served as assistant city engineer of Alameda, Calif., for several months, has been appointed temporary successor to C. E. Hickok, city engineer, now on leave of absence and a captain in the engineer corps at Camp Lee, Virginia.

OBITUARY

JOSEPH MCG. LANIGAN, formerly of Syracuse, N. Y., a cadet in the aviation camp at Fort Worth, Tex., was instantly killed Mar. 16 by a fall while making a trial flight. Mr. Lanigan, who was 27 years old, was graduated from Syracuse University in 1913. After a short period with the U. S. Coast and Geodetic Survey he became a member of the editorial staff of *Engineering Record*, where he remained until the end of 1914. He then became connected with the Austin Construction Co., Cleveland, and remained with that company in various capacities and at various points until his enlistment last October. His last work before enlistment was as purchasing agent on the $2,000,000 Curtiss-Wright airplane plant at Buffalo.

FRANK MCEACHERN, secretary and treasurer of J. A. McEachern & Co., bridge, wharf and pile driving contractors, Seattle, was found dead in the back seat of an automobile near the company's offices in Seattle Apr. 9. There were two bullet holes in his head. Officials called it a case of suicide, but admitted that all circumstances surrounding the case had not been cleared up. Mr. McEachern was in the employ of the Puget Sound Bridge & Dredging Co., Seattle, for eight years, until the firm of J. A. McEachern & Co. was formed by three brothers.

NEWS OF ENGINEERING INDUSTRIES

FOR MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Fuel Administration Restricts Clay Products Output

Orders Affecting Other Industries Expected to Follow—Present Order Insures Supply

The United States Fuel Administration has issued regulations, approved by the War Industries Board, placing definite restrictions on the manufacture of clay products, through a rearrangement and division of the manufacturing program of this industry. Since the regulations contemplate furnishing these industries with definite quantities of fuel, sufficient for maintaining fixed percentages of the previous average output, it is thought that the new order will serve as practical assurance to users of brick, pipe, tile and other clay products of a supply adequate for the curtailed demands of the war period.

Manufacturers of hollow tile, drain tile and sewer pipe will be allowed a supply of coal sufficient for producing 75% of their average capacity, measured by the production of the past three years. Manufacturers of face brick, common brick, paving brick, terra cotta, roofing tile, floor and wall tile and sanitary wares will be allowed a fuel supply sufficient for producing 50% of their average output on the same basis. Firms manufacturing stoneware will be required to restrict their output only 15%, while firms manufacturing chemical stoneware are not included in the order.

Other Orders Expected

It is thought that the present order is the first of a series of similar orders which will affect other building trades industries. The Fuel Administration announces that the restrictions have been ordered after careful investigation and that they represent rates of production calculated for the best interests of the necessary Government work and in general for the interests of the manufacturers involved.

It is stated that the experience of the last year has brought two facts clearly to the front: (1) That as far as possible new war work must be placed in old factories confined to less essential production, in order to avoid building, housing and transportation problems which necessarily follow the setting up of new plants for war production; (2) that in addition to this transfer it will be necessary for many industries to make deliberate sacrifices of a part of their ordinary business in order that there may be transportation facilities, men and materials enough for war production.

The Fuel Administration announces that for several months it has been obtaining information jointly with the War Industries Board which would permit the reorganization of less essential industries, such as those producing building materials, which tax transportation facilities and fuel supplies to the largest extent.

The present order provides that pooling of manufacturing facilities will be permitted wherever it can be shown that such an arrangement would save fuel. No new plants may be started and no plant is to undertake the manufacture of new products without the special permission of the Fuel Administration.

Individual Claims Allowed

Manufacturers will have the right to present their individual claims to the Fuel Administration for securing special permission to increase operations to fill orders when it is found that the demand of the market cannot be supplied. Such special permission will be granted upon evidence that the necessities of the Government in the particular district in which a manufacturer is located cannot be supplied by plants within practical shipping distance without the granting of an exception to the general rule.

Equal treatment for all plants is provided wherever possible. Allowance, however, is made in the plant for recognizing individual instances where an abundance of fuel and absence of congestion make it desirable to permit a large proportion of production in a given district. The granting of the right to produce such additional output is safeguarded so that general conditions in the different trades will not be seriously affected.

President Expected to Name Labor Director

It is expected in Washington that President Wilson will soon name a national Labor Administrator, who will have charge of all labor problems involved in the production of war supplies. In this case it is understood that the duties now performed by the present labor bureaus in the Government departments which deal with war materials production will be taken over and coördinated by the new officer.

Building Officials' Conference to Meet in Chicago

The 1918 building officials' conference will be held at the La Salle Hotel, Chicago, May 9-11, in connection with the annual meeting of the National Fire Protection Assn., the business sessions of which will be held on May 7-8.

Steam Shovels and Mixers Puzzle Foreign Buyers

A Letter from New Zealand Which Shows Need for Careful Instructions on Equipment

To the manufacturer of construction equipment who imagines that his ordinary catalogs will suffice for any English-speaking country, the letter printed below reveals some interesting facts. Instead of a commonplace, almost a "staple," article of equipment, the revolving steam shovel is an unsolved mystery in some quarters of the globe; a concrete mixer becomes a complex puzzle; tower and chute equipment may be unknown.

Literature sent with plant or equipment sold to distant countries should be fully descriptive. It should outline the correct method of laying out, unloading, assembling and erecting equipment. It should detail the method of operation and the number of men needed for each kind of work done in connection with the plant. If you have any doubt of the worth of these suggestions, read this letter received by an American manufacturer from a construction man in New Zealand:

"New Zealand is far away from the center of up-to-date methods, and I must confess, it is the general thing to see fair-sized jobs going on where the methods of construction and the plant in use are very primitive. The class of labor, both skilled and unskilled, taken on the whole throughout the country, is poor. Therefore the cost of a job is very dear in comparison with the same work where good labor and labor-saving machinery are used.

"Labor-saving machinery in this country is always noticeable by its absence on any job. The trouble seems to me to be caused by the fact that there are no means here for contractors to get advice, or information about cost, or any details, about any plant they would require for the speeding up of their work, and worse still is the fact that there are no expert or specialized supply houses.

Steam Shovel Never Started

"For instance, a few weeks ago I visited a contractor who had been supplied by a local agent with a concrete mixer, ordinarily sold in the United States for about £75. The contractor was charged £220 here. When I went on to the job several weeks later the contractor and his foreman could not run it until I showed them. The agents did not know the elementary principles of it.

"I must tell you that a part of the trouble which needs overcoming in this

country is that the engineers and inspectors need educating in the use of plant. When you accomplish this there will be a large sale of suitable plant, because, as I said before, good labor is scarce, and after the war machinery must be used to make up for the lost labor.

"I will give you an instance to confirm this. I am acquainted with a piece of work (railway cuttings, etc.) where there is a steam shovel. Well, that shovel is in just about the same place as it was when unpacked two years ago. The engineer in charge on the job says he cannot do any good with it, and prefers to use the hand wheelbarrow. The same job let a contract to a team of men and horses to do some grading at one shilling per yard in soft loam soil. They could not make it pay, so barrows finished it."

This letter suggests, too, the need for export connections which are able to give service and instruction to users of equipment shipped abroad. Many big manufacturers have their own representatives who are close enough to their trade to see that equipment is set up properly and used to best advantage. There are a number of big export organizations also giving this service to manufacturers and purchasers.

Market for Construction Materials and Machinery in Colombia

"Construction Materials and Machinery in Colombia" is the title of a new report just issued by the Department of Commerce. It was prepared by Special Agent W. W. Ewing, who has just finished a personal investigation on the ground.

The report contains a general introduction covering the industries, resources, means of communication, architecture, and construction of the country, and chapters devoted to specific building activities, markets for particular lines of materials and machinery, and commercial practices and requirements.

Mr. Ewing reports that Americans have a bigger business in Colombia now than before the war, and sees no insurmountable obstacles in the way of doing even better when peace is made. Copies of the report can be obtained by application to the superintendent of documents, Washington, D. C., or to any of the district offices of the Bureau of Foreign and Domestic Commerce.

Only Half Capacity of Structural Shops Contracted For

Figures collected by the Bridge Builders and Structural Society during March show that only 47% of the capacity of the bridge and structural shops of the country was contracted for. This condition is understood to be due to the inability of the mills to keep the shops supplied with a sufficient quantity of plates and shapes to maintain maximum production, rather than to a shortage of orders for delivery in the near future.

Foreign Trades Council Discusses After-War Commerce

The fifth annual convention of the Foreign Trades Council, held in Cincinnati last week, was characterized by the optimistic attitude of the speakers regarding after-the-war commerce and general industrial conditions. James A. Farrell, of New York, chairman of the National Foreign Trades Council, president of the United States Steel Corporation, in speaking on "Foreign Trade Aspects," said, "We shall see such an increase of the world's work as will go far to compensate for the appalling destructions which the past four years have witnessed." Mr. Farrell emphasized the fact that the gigantic task now confronting the United States was not only to win the war and insure the continuance of our own national existence, but also that "our great resources should be fully utilized for the restoration of the decadent industry of shipbuilding."

It was emphasized by the speakers at the convention that there would be a large amount of American shipping available for foreign trading after the war. It was pointed out that a natural outcome would be the formulation of a definite plan of international coöperation in the financing of foreign trade and enterprises.

Robert S. Alter, of Cincinnati, president of the American Tool Works Co., declared that export-trade problems of the past will likely not be identical with those of the future after peace is declared. "America should realize that conditions will change," said Mr. Alter, "and we Americans should give the best of our thoughts, individually and collectively, in an endeavor to ascertain just what the requirements will be to develop and maintain that vast amount of foreign trade obtainable after the war, said by many to be within easy reach of us all."

Employment Managers Training Under Government Auspices

The first course of intensive training in employment management under Government supervision opened at the University of Rochester, N. Y., Mar. 26, according to an announcement recently made by Henry P. Kendall, chairman of the committee on industrial relations of the United States Chamber of Commerce. Twenty prospective employment managers, sent by manufacturers having war contracts, including especially shipbuilding plants and several departments at Washington, began to take six weeks' intensive training in the practice and theory of employment management. Fifteen Rochester factories are providing the laboratory work and assisting the University of Rochester in presenting the theory of personnel management.

The course is given at the express request and under the supervision of the industrial service sections of the several departments at Washington, including the Emergency Fleet Corporation, the Ordnance Department, the Quartermaster Department, the Department of Labor, and the Navy. The work has the endorsement of the educational committee of the general staff of the War Department and the War Industries Board. The storage committee of the latter has undertaken the organization of the work.

Any member of the National Chamber of Commerce that wishes to apply to send a student to one of these courses should write to Employment Managers' Division, 5207 New Interior Building, Washington, D. C., which is handling the detail work for the various departments coöperating. The next course will be opened at Boston with Harvard University, Massachusetts Institute of Technology and Boston University coöperating in the instruction, and the Boston Employment Managers' Assn. directing the laboratory work. Applications for this course should be made immediately.

Bucket Excavator Does Heavy Trenching Work

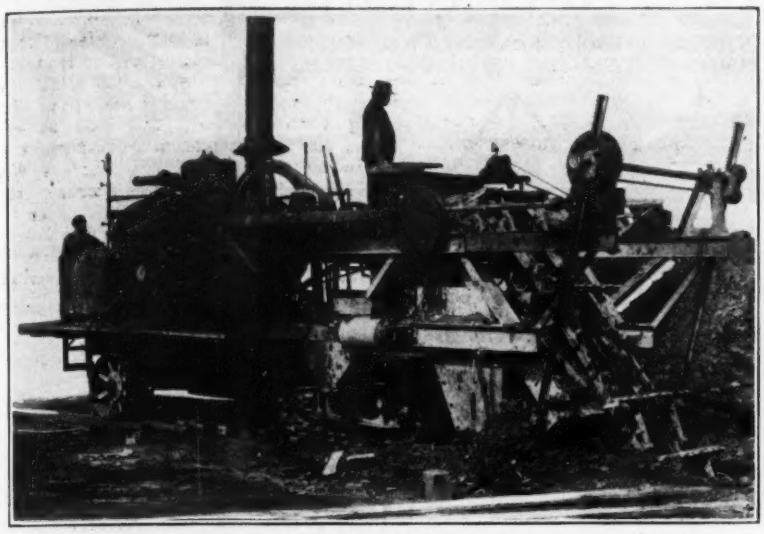
Steam shovels have been used to a great extent for heavy trenching work where the character of material handled and the width of cut were beyond the capacity of trenching machines. For the purpose of performing this class of work more rapidly, a trenching machine has been introduced which is of the ladder bucket type but built along heavy steam shovel lines. It is shown in the accompanying illustration.

The gears, bearings, shafts, engines and boiler of the machine are built to steam shovel standards, and all of its parts and fittings are designed for extra strength, with a view to handling heavy trenching work. The buckets are of the open or scraper type, attached to the chain links by steel arms, and can readily be removed when changing from one size to another. They are furnished in widths of 72, 60, 48, 36 and 24 inches.

In addition to providing a simple means of connecting the bucket to the links, the steel arms give the bucket a forward motion when passing over the upper tumbler, so that they may be easily cleaned when operating in sticky material. This motion also throws the material forward onto the conveyors so that it does not fall back into the trench.

The standard ladder is designed to dig a maximum of 17 feet below wheel base, the same ladder being used for each size bucket. It is provided with a removable section which may be taken out when digging 12 ft. or less, and can be furnished with an extension to dig to a depth of 20 feet.

The conveyor is driven by an independent reversible engine, so that its speed is independent of the operation of the bucket. It is controlled by levers



TRENCHER BUILT ALONG HEAVY STEAM SHOVEL LINES

at the operator's stand, and run in either direction at any speed of 650 ft. per min., permitting work to be done in close quarters, where it is necessary to deposit the material on both sides, or in caving material, where the conveyor is called upon to handle an excess output.

The machine is mounted on caterpillar traction at the rear and traction wheels at the front. The variation of digging speed is controlled by a lever at the operator's stand, and may be changed without stopping the machine. The operator's stand is located on top of the frame at the head of the digging ladder, giving a view of the bottom of the trench as well as of the road ahead.

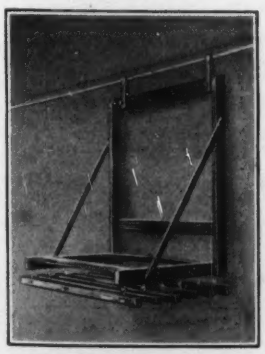
The approximate total weight of the machine in working order is 36 tons. The length over all, without ladder, is 33 ft.; the length with the ladder raised is approximately 54 ft. The height over all is 15 ft., and the width over the caterpillars is 10 feet.

This trenching machine has been placed on the market by the Bucyrus Company, of South Milwaukee, Wis.

New Folding Wall Rack for Filing and Holding Drawings

For filing and holding drawings, schedules and records in the office and drafting room a new folding wall rack has been produced by the National Co., of 273 Congress St., Boston. The rack consists of a wooden frame, as shown in the accompanying illustration, which is supplied with hooks for suspending from molding, or which can be folded and nailed to the wall. When not in use the rack can be folded against the wall, and a removable index card in the frame readily shows the contents of the holder.

The capacity of the rack is 60 prints or sheets, using six special folders manufactured for the purpose.



BUSINESS NOTES

C. P. Coleman has been elected president of the Worthington Pump & Machinery Corporation. Mr. Coleman advances from the position of vice-president, which he has held since May, 1916. After his graduation from Lehigh University he was employed in various positions by the Lehigh Valley R. R. until 1903, when he was made secretary and treasurer of the Singer Sewing Machine Co., and put in charge of the construction of the Singer Building, New York City. In 1914 Mr. Coleman became vice-president of the International Steam Pump Co., which was later organized into the present Worthington Pump & Machinery Corporation.

The American Abrasive Metals Co., New York, manufacturers of anti-slip treads, has opened a branch office in the Conway Building, Chicago, in charge of R. L. Brown.

R. W. Douglas has resigned as manager of the Seattle Master Builders Assn., which position he has held for the last three years.

The Howes Foundry & Equipment Co. has recently acquired the Central Bronze Co., which will coöperate with the plant of the Howes company in the manufacture of bronze valves and fittings.

Col. Henry T. Bope has resigned his position as vice-president and general manager of sales of the Carnegie Steel Co., to devote his time to private interests. William G. Clyde has succeeded to the position. Mr. Clyde's connection with the United States Steel Corporation dates from 1894. Charles L. Wood, previously assistant to Mr. Clyde, has been promoted to assistant general manager of sales in charge of the bureau of bars and hoops.

The George B. Curd Co. has purchased a plant in Cincinnati, which will be devoted to rebuilding and repairing railroad equipment.

The Blaw-Knox Pressed Steel Co. will discontinue its plant at Wheatland and will concentrate its work at Hoboken, near Pittsburgh.

The Union Smelting & Refining Co., Inc., has opened its new plant at Avenue L and St. Charles St., Newark, N. J.

Dwight K. Bartlett, assistant manager of the Builders' Iron Foundry, Providence, R. I., is to become manager of Electro Bleaching Gas Co.'s New York office.

TRADE PUBLICATIONS

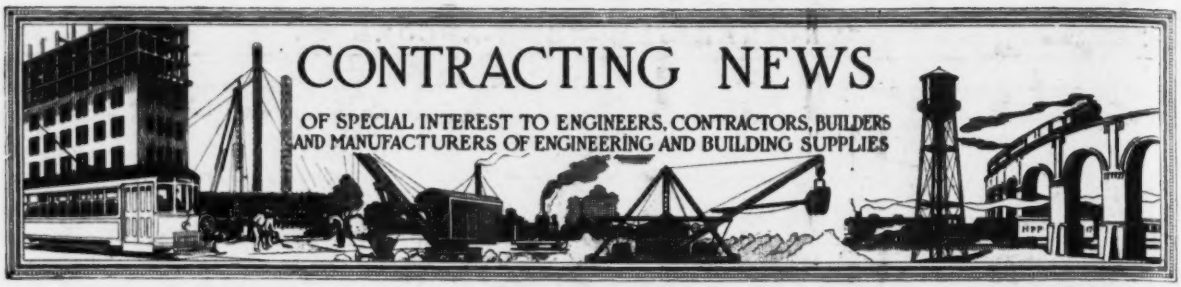
"Blaw Automatic Single Rope Cableway Carriages" is the title of a new folder published by the Blaw-Knox Company.

The International Motor Co. has issued a 23-page leaflet illustrating various types of Mack motor truck bodies.

On account of the development in deep well drilling, which has called for heavier and more specialized equipment, the Carnegie Steel Co. has issued the fifth edition of its pamphlet entitled "Steel Derricks and Drilling Rigs."

The F. C. Austin Co. of Chicago has issued a new 83-page catalog entitled "Austin Cube Mixer." The catalog contains numerous illustrations and descriptions showing the uses of various types of Austin mixers.

The Nisqually Iron Works, Tacoma, Wash., have issued a 31-page pamphlet entitled "Concrete Pipe Machines," containing descriptions of the various types and uses of Hammond pipe machines.


CONTRACTING NEWS
OF SPECIAL INTEREST TO ENGINEERS, CONTRACTORS, BUILDERS
AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES

Proposals

For Proposals Advertised See Pages 51- 51a- 51b- 52- 53 Inclusive

WATER-WORKS

Bids Close		See Eng. News-Record
Apr. 26	Boston, Mass.	Apr. 25
Apr. 30	Defiance, O.	Apr. 25
Apr. 30	Hartford, S. D.	Apr. 25
May 1	York Twp., Ont.	Apr. 18
May 1	Ashland, Pa.	Apr. 25
May 4	Manitowoc, Wis.	Apr. 25
May 6	Mineral Wells, Tex.	Apr. 25
May 6	Tucson, Ariz.	Apr. 25
May 6	Santa Paula, Cal.	Apr. 11
May 7	Ft. Worth, Tex. Adv. Apr. 11, 18 and 25.	Apr. 11
May 10	Bushnell, Neb.	Apr. 25
May 22	Chicoutimi, Que.	Apr. 25

SEWERS

May 1	West Park, O.	Apr. 4
May 1	Parsons, Kan.	Apr. 25
May 2	Cleveland, O.	Apr. 25
May 6	Wahpeton, N. D.	Apr. 18
May 6	Pinebluff, Wyo.	Apr. 25
May 7	West Park, O.	Apr. 18
May 7	Sleepy Eye, Minn.	Apr. 25
May 7	South Orange, N. J.	Apr. 25
May 8	North Arlington (Arlington P. O.) Adv. Apr. 25.	Apr. 25
May 16	Brainerd, Minn.	Apr. 25
May 18	Martinsburg, W. Va.	Apr. 25

BRIDGES

Apr. 29	New Phila., O.	Apr. 11
Apr. 29	Uniontown, Pa.	Apr. 11
Apr. 29	Lancaster, Pa.	Apr. 18
Apr. 29	Bronxville, N. Y. Adv. Apr. 18 and 25.	Apr. 18
May 1	Vallejo, Cal.	Feb. 7
May 1	Abbott, Me.	Apr. 18
May 1	Monticello, Me.	Apr. 18
May 1	Hohenwald, Tenn.	Apr. 25
May 3	Tunesassa, N. Y. Adv. Apr. 18 and 25.	Apr. 18
May 4	Hayfield, Minn.	Apr. 25
May 6	Belva, W. Va.	Mar. 28
May 6	Burford Twp., Ont.	Apr. 18
May 6	Long Prairie, Minn.	Apr. 18
May 6	Lawrence, Mass. Adv. Apr. 18 and 25.	Apr. 18
May 6	Seymour, Ind.	Apr. 25
May 6	Redding, Cal.	Apr. 25
May 6	Hartford City, Ind.	Apr. 25
May 7	Parsons, W. Va.	Apr. 18
May 7	Lake Worth, Fla.	Apr. 11
May 7	Van Horn, Wash.	Apr. 25
May 7	Reading, Pa. Adv. Apr. 25.	Apr. 25
May 8	Williamsport, Pa. Adv. Apr. 25.	Apr. 25
May 8	Peru, Ind.	Apr. 25
May 9	Holloway, Minn.	Apr. 11
May 14	Milton, Fla.	Apr. 25
May 14	Modesto, Cal.	Apr. 25
May 16	Harrisburg, Pa.	Apr. 25
May 20	Charleston, W. Va.	Apr. 18

STREETS AND ROADS

Bids Close		See Eng. News-Record
Apr. 26	Indiana	Apr. 18
Apr. 26	Trenton, N. J.	Apr. 25
Apr. 27	Huntington, N. Y.	Apr. 25
Apr. 29	Kirkland, Wash.	Apr. 18
Apr. 29	Edgewood, W. Va. (Wheeling P. O.)	Apr. 11
Apr. 29	Ohio	Apr. 11
Apr. 29	Goldendale, Wash.	Apr. 18
Apr. 30	Michigan	Apr. 4
Apr. 30	Massachusetts	Apr. 25
Apr. 30	Omaha, Neb.	Apr. 25
Apr. 30	Detroit, Minn.	Apr. 18
May 1	Vancouver, Wash.	Feb. 14
May 1	Brainerd, Minn.	Mar. 28
May 1	Canyon City, Ore.	Apr. 11
May 1	Edwardsville, Ill.	Apr. 11
May 1	Maine	Apr. 11
May 1	Peoria, Ill.	Apr. 25
May 1	Sheboygan, Wis.	Apr. 25
May 2	New York, N. Y.	Apr. 25
May 3	Topeka, Kan.	Apr. 25
May 3	Buffalo, N. Y.	Apr. 25
May 3	New York, N. Y.	Apr. 25
May 4	Butler, Pa. Adv. Apr. 25.	Apr. 25
May 6	Lisbon, O.	Apr. 25
May 6	Camden, N. J.	Apr. 25
May 6	Fairfax, Va.	Apr. 25
May 6	Red Lake Falls, Minn.	Apr. 25
May 6	Norfolk, Neb.	Apr. 11
May 6	Fayetteville, W. Va.	Apr. 18
May 6	Washington	Apr. 18
May 6	Indiana	Apr. 18
May 6	Washington	Apr. 25
May 7	Nevada, Mo.	Apr. 25
May 7	Brainerd, Minn. Adv. Apr. 25.	Apr. 25
May 7	Thief River Falls, Minn.	Apr. 18
May 7	Nevada, Mo.	Apr. 25
May 7	Indiana	Apr. 18
May 7	New York Adv. Apr. 18 and 25.	Apr. 18
May 7	North Dakota	Apr. 4
May 7	Gadsden, Ala.	Apr. 11
May 7	Santa Barbara, Cal.	Apr. 25
May 8	Indiana	Apr. 18
May 8	Summerville, W. Va.	Apr. 25
May 9	Pennsylvania Adv. Apr. 18 and 25.	Apr. 18
May 9	Jersey City, N. J.	Apr. 25
May 10	Albert Lea, Minn.	Apr. 25
May 13	Louisiana	Apr. 25
May 13	Tennessee	Apr. 25
May 14	Chaska, Minn.	Apr. 25
May 14	Pensacola, Fla.	Apr. 25
May 15	Delaware	
May 16	Stillwater, Minn.	Apr. 25
June 1	Oswego, Kan.	Mar. 28
Aug. 1	Cleveland, O.	Mar. 28

EXCAVATION AND DREDGING

Apr. 29	Ellice (Rostock P. O.) Ont.	Apr. 18
Apr. 30	Albany, N. Y. Adv. Apr. 18 and 25.	Apr. 4
Apr. 30	El Centro, Cal.	Apr. 25
Apr. 30	Clarion, Ia.	Apr. 25
May 1	Stiles, Wis.	Apr. 4
May 2	North Gower, Ont.	Apr. 18
May 3	Burlington, Ia.	Apr. 25
May 3	Mankato, Minn.	Apr. 25
May 6	Lamar, Colo.	Apr. 25
May 7	Worthington, Minn.	Apr. 25
May 9	Jersey City, N. J.	Apr. 18
May 9	Blytheville, Ark. Adv. Apr. 18 and 25.	Apr. 18
May 13	Greenville, Miss. Adv. Apr. 18 and 25.	Apr. 18
May 15	Chillicothe, Mo.	Apr. 25
May 23	Greenville, Miss.	Apr. 18

INDUSTRIAL WORKS

May 1	Menominee, Wis.	Apr. 25
May 1	Marion, Ind.	Apr. 25
May 10	Bedford Hills, N. Y.	Apr. 25
May 18	Cleveland, O.	Apr. 18

BUILDINGS

Apr. 26	Hartford, Conn.	Apr. 25
Apr. 26	Yonkers, N. Y.	Apr. 25
Apr. 29	Erie, Pa. Adv. Apr. 18 and 25.	Apr. 11
Apr. 30	Cincinnati, O.	Apr. 11
Apr. 30	Newell, S. D.	Apr. 18
Apr. 30	Orange, Tex.	Apr. 18
May 1	Greenville, S. C.	Apr. 4
May 1	Cleveland, O.	Apr. 18
May 1	Waterbury, Conn.	Apr. 18
May 3	Humboldt, Ia.	Apr. 18
May 4	East Cleveland (Cleveland P. O.)	Apr. 18
May 5	Whitesboro, N. Y.	Apr. 25
May 6	Ivanhoe, Minn.	Apr. 25
May 7	Gainesville, Tex.	Apr. 18
May 8	Charleston, S. C.	Apr. 18
May 13	Superior, Wis.	Apr. 18
May 15	Jersey City, N. J.	Apr. 18
June 15	Phila., Pa.	Mar. 28
May 16	Herkimer, N. Y.	Apr. 25
May 17	Washington, Ia.	Apr. 25

FEDERAL GOVERNMENT WORK

Apr. 26	Dredging — New London, Conn. Adv. Apr. 11.	Apr. 11
Apr. 29	Post Office and Court House —Paris, Tex. Adv. Mar. 28.	Mar. 28
Apr. 29	Water Supply Pipe—Newport, R. I.	Apr. 18
Apr. 29	Heating and Lighting—New London, Conn.	Apr. 18
Apr. 29	Piping System — Philadelphia, Pa.	Apr. 18
Apr. 29	Fire Alarm System—Chelsea, Mass.	Apr. 18
Apr. 29	Fire Protection System — Hingham, Mass.	Apr. 18
Apr. 29	Pipe Tunnel — Washington, D. C.	Apr. 25
Apr. 29	Storehouse, Lake Denmark, N. J.	Apr. 25
Apr. 29	Addition to Clothing Factory Charleston, S. C.	Apr. 25
Apr. 29	Barracks—Pensacola, Fla.	Apr. 25
Apr. 30	Heating System — Shawnee, Okla.	Apr. 11
Apr. 30	Boiler and Pump — Cape Vincent, N. Y. Adv. Apr. 18.	Apr. 18
Apr. 30	Structural Steel and Accessory Parts, Wash., D. C. Adv. Apr. 18 and 25.	Apr. 11
Apr. 30	Passes, Meirs, etc.—Wheeling, W. Va. Adv. Apr. 18 and 25.	Apr. 18